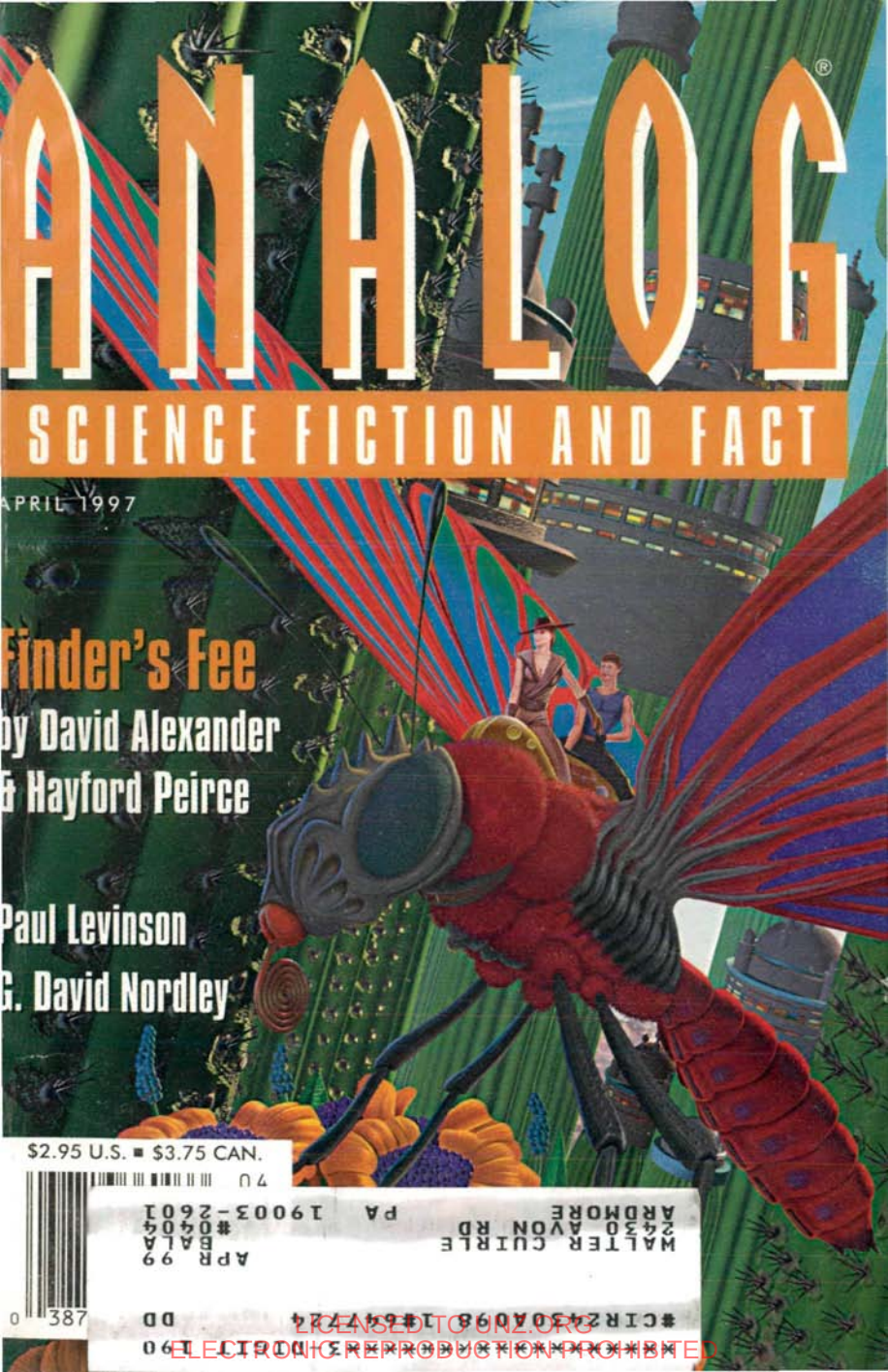
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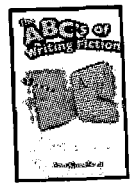

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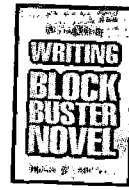

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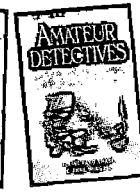

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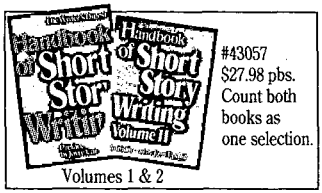

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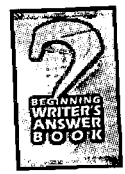

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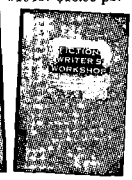

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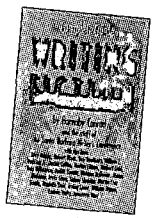

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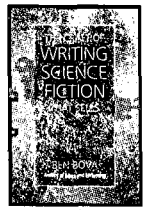

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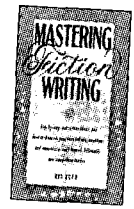

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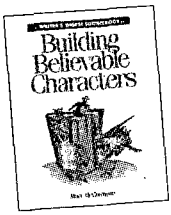

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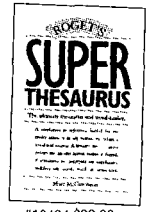

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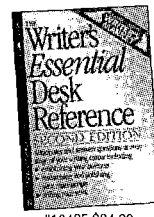

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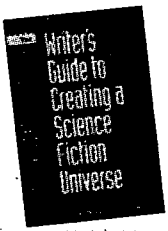

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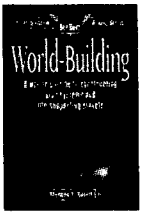

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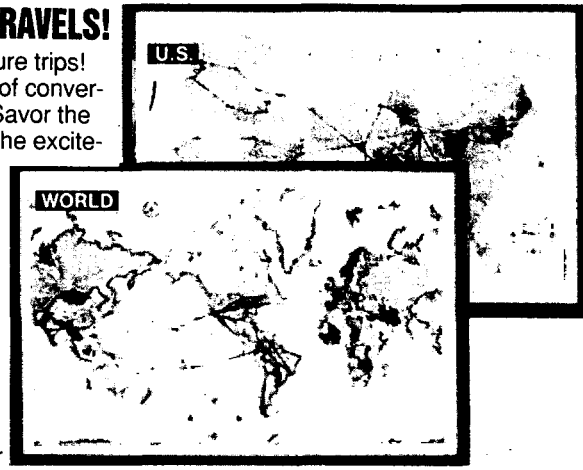

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PUBLIC VERSUS PRIVATE

Back in October, I commented here on "The Forever Fallacy": the trap of believing that anything lasts forever—especially anything that depends on politicians keeping their promises. My main example was a movement afoot in the federal government to sell off portions of national parks and other public lands to private enterprise. Many readers largely agreed with my comments, but a number of them (respectably if not impressively into the single digits) attacked me in no uncertain terms for "defending the socialized park system."

When I wrote "The Forever Fallacy," it never occurred to me that I was doing anything so grandiose. My intent was merely to point out the threat I saw in a move that seemed likely to destroy something that needs to be preserved. But those readers' comments did raise an interesting question, particularly since in large measure I agree with them in principle. It's quite true, as one of them pointed out, that the concept of individual liberty coupled with personal responsibility has long been (and will continue to be) an ideal that has shaped much of the thinking in *Analog*'s pages. So how can I object to "privatizing" *anything?*

The difference between my critics and myself, I think, is that their thinking is dominated by one principle, with little or no regard for others. I feel strongly about several principles, of which individual freedom is high on the list. But I am not so single-mindedly fixated on any one of them that I'm unwilling to consider others at the same time.

Personally, I'm an anarchist at heart—but that does *not* mean I'm a "terrorist" or advocate violent overthrow of the government. I simply agree in principle with whoever it was (Jefferson?) that said, "That government is best that governs least." My idea of Utopia is a place where everyone is so wise, benevolent, and responsible that no government is necessary to insure smooth functioning of the infrastructure and ample opportunity for all to create safe, comfortable lives in accordance with their own tastes and principles.

Unfortunately, I don't live there. In the real world as we know it, I fear, a certain amount of government is a textbook example of "necessary evil"—with equal emphasis on both words. Furthermore, while private enterprise and commercial competition

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do some very important things very well, they do not necessarily do *everything* better than any other possible method. And sometimes getting things *done* is more important than *how* they get done.[1]

To answer the critics who fear I've turned from a (lower-case) libertarian to a (lower-case) socialist because I've criticized a proposal for the government to privatize one specific thing, I must respond on two levels. First, and simpler, is the pragmatic question of what seems the best or least harmful course of action *within the limits of the world as it exists or as I can reasonably hope to change it.*

Given the reality that I *will* be taxed, parks and wilderness preserves seem to me one of the more worthwhile ways my taxes can be spent. I think they serve important functions, not just for me, but for the country at large. Sometimes I think they're one of the few government programs that *are* worthwhile—and if I *must* pay taxes, I'd rather see them spent on something worthwhile than wasted. No, I *don't* like someone else deciding how to spend my money.[2] But given that it's going to happen anyway, I am less unhappy with expenditures that do something important. Parks are important, we now have them, and selling them to loggers seems an improbable way to preserve them.

The second, and more complicated, question is whether the system itself is a good one. That is, even if preserving wild lands is important, is government ownership and control of them a good, or even a defensible, way to do it?

One reader objects to it, and to "*any* socialist mechanism," because it demands support under threat of force from those who would rather not support it. This reader has a carefully thought-out system of ethics founded on the principle that force (in his

[1] No, I'm not saying, "The end justifies the means"—though it often does, to a considerable extent. The reason that slogan has fallen into disfavor is that it doesn't make allowance for the fact that, "You can't do just one thing." That is, whatever you do has side effects in addition to the one you are after. Those are part of the real "end," and so must be taken into account in evaluating options.

[2] I'd love to see somebody try the system suggested in the story "We, the People," by Jack C. Haldeman II (*Analog*, Mid-September 1983), wherein people pay taxes but specify how much of them is to be spent on what!

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word, "violence") for any reason except self-defense (or assisting someone else's defense of person or property) is wrong and must be avoided at essentially any cost. I can sympathize with that; it's strongly akin to my own fundamental moral principle, that people should be free to do whatever they want as long as it doesn't hurt anybody else.

However, I don't think that direct physical violence is the only way to hurt somebody. Nor do I think other *humans* are the *only* thing that should be considered in making ethical decisions. I may never see the neighbor who lives a mile downriver from me, but I can certainly hurt him by dumping barrel after barrel of toxic waste into it. He is quite justified in making me cease and desist, forcibly if necessary. And while either of us might reasonably catch as many fish as we and our families can eat, neither of us needs—or should expect to be allowed—to slaughter vast numbers of them indiscriminately, *whether or not* other humans will later need them for food.

The principle of "anybody can do anything except violence" works well as long as no individual has very much power to affect other people or the environment. Conceivably it *could* work well even then, if everybody could be trusted not to abuse their power—but history has abundantly demonstrated that, in the world as it has existed so far, they can't. A regrettable side effect of the increase in individual power brought by technology is that it becomes harder and harder to leave people entirely to their own judgments. The same technologies that enable individuals to do more desirable and beneficial things

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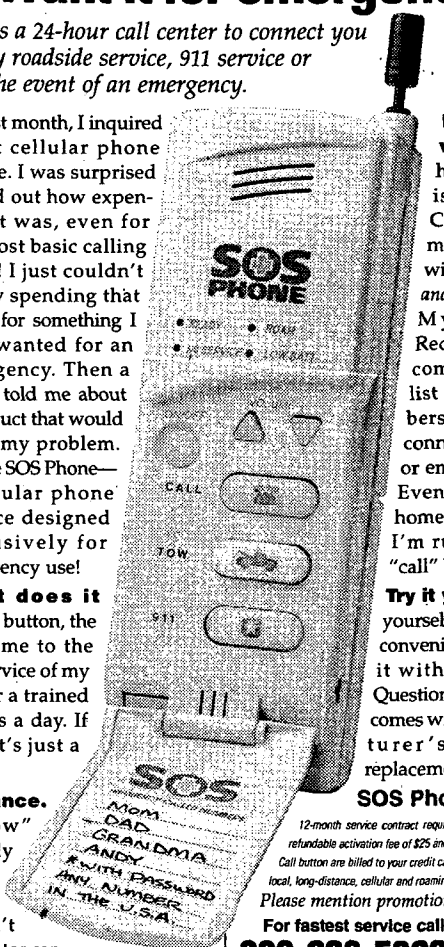

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also enable them to do lots of damage with unprecedented ease, and it's Not Smart to let them do so. If preventing at least the more extreme possibilities requires some measure of public control, that may be the lesser evil.

However, please note: If no coercion is allowed, *no* public works are possible. If everything is private, you're completely dependent on private good will, competence, and coordination. In theory, at least, it's possible to have a road system entirely in private hands, financed by tolls. Of course, you may have to stop and fork over a new toll on every road you turn onto, and you may not be allowed to turn onto some of them if the owner doesn't like you. In principle, I suppose, that's the way it *should* be, if nobody's allowed to coerce anybody.

Of course, drivers may object that the system's unfair because even though they're the *direct* users, they're not the only ones deriving benefit from the roads. Anyone using anything trucked in from outside his immediate neighborhood is indirectly using them and should pay some of their costs. Right, say the road owners to the truckers—so build something into your prices to collect a fair share of the tolls from your customers.

No doubt there are some who think such a system would be wonderful. I think it would be such a confounded nuisance as to outweigh its theoretically superior fairness. I don't give up freedoms lightly; but after careful consideration, I am less bothered by paying a reasonable tax to support an extensive public road system than I would be by the constant aggravation of paying tolls to a zillion road owners and wondering which ones will refuse to let me pass even if I pay their price.

So: Yes, I am basically libertarian, but my experience strongly suggests that for a few things public or government control has enough advantages to make it worthwhile anyway. If you agree (and I realize that some never will), then you're stuck with allowing a limited amount of coercion. The question then becomes, when and why is such centralized control justifiable?

I've already said why I suspect roads are one example: The bookkeeping for a private substitute is likely to be more trouble than it's worth, and subject to individual abuses hardly distinguishable from those of corrupt government officials. Similar arguments could well apply to other transportation networks such as waterways and air space. (Do you really want anybody to be able to try flying a plane around your neighborhood, with no assurance that he knows how?) Public education is another example, because everybody suffers if the country is run by the abysmally ignorant—and how many of the poor would get even minimal education if they had to buy it from private vendors?[3] Preservation of wild lands fits the category for related reasons: One of its most important functions is as another aspect of public education.

At least one reader who comment-

[3]Yes, I know the public schools we have now leave much to be desired. That's a reason to improve them, not to do away with them.

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ed on "The Forever Fallacy" clearly doesn't care whether any wild lands are protected or the general population ever has a chance to see any. He says, "You want wild lands; buy some." He also mentions private organizations like The Nature Conservancy, which preserves land by buying it and maintaining it as wilderness. Good ideas, as far as they go; I've personally bought land for the express purpose of keeping it undeveloped, and I've been a member of The Nature Conservancy for years. But neither I nor relatively small organizations like The Nature Conservancy can do very much compared to the national park system. Yes, I *could* do more—if I wanted to devote all my time and funds to that at the expense of everything else I might also care about. But that's a highly unsatisfying solution, and a great many others would find it so, too.

Tough, says this reader; decide what's important to you and put your money where your mouth is. But he misses the point—several of them.

I didn't start all this just because *I* want a chunk of wilderness, but because I think a wilderness experience needs to be *available* for *everybody*—especially children. If at least some of them are exposed to something beyond the artificiality of cities, maybe they won't grow up as abysmally and dangerously ignorant of ecology as many present adults.

Only those who already know enough about wilderness to understand its value will be motivated to buy it. Only the relatively well-off will be able to. Those who do buy their own have only a little piece of one ecosystem, and may not choose to share it. Organizations like The Nature Conservancy can buy some, but generally not really large tracts—and true wilderness cannot be preserved in half-acre parcels.

Things like the national park system have two main values. They can preserve *large* expanses, big enough to house fully functional ecosystems. And they enable people who *don't* already understand wilderness and its value—e.g., casual vacationers—to discover it. They even let those "toe-dippers" experience not just the one little piece of an ecosystem that a non-wealthy person might own, but something of the *diversity* this planet has produced. A family that can save up time and money for one vacation per summer might see the Maine seacoast at Acadia one year, the Florida Everglades the next, the desert of Joshua Tree in another, and the geological storybook of Grand Canyon in still another.

Naturally, it's reasonable to expect the actual users to pay more than the nonusers. (I once complained emphatically when I found that Congress had inadvertently abolished user fees on a lot of federal lands that I was camping on, and was relieved when they were restored.) But until shown convincing reasons to do otherwise, I will persist in the belief that the public subsidy is worthwhile to keep the opportunity to visit places like Olympic and Denali open to any family that can save up enough to get there (subject, of course, to capacity).

Another reader seems to under-

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stand the value of preserving wilderness, but thinks private ownership will do a better job. But will it? To show how Private is better than Government, he suggests comparing a fast food restaurant (where you "get a product you want at a fair price") and a government office (where you "pay a high price for slow rude service that you did not even want"). His comparison between those examples is valid, but the examples chosen have little to do with How to Protect Wilderness. A better comparison would be between a national park and Disneyland. The customers at both get what they want, but they're looking for different things. An even better, and very direct, comparison might be between Great Smoky Mountains National Park (which offers some of the finest backcountry camping in the country) and the garish honky-tonk of tourist traps that private enterprise has created just north of it.

One reader claims "corporations last longer than governments." A very few have, but the generalization is farfetched, to say the least; huge numbers of corporations are born and soon die during the life of almost any country. He also says, "If you've been to a major western US park, you probably don't like what has already been done." Well, I've been to most of them, and while I'm not entirely pleased, I like them better as they are than if they'd been strip-mined or developed like Disneyland. And from all I've seen, those are the kinds of things most likely to happen to them if they were sold to private outfits. I'd like to believe otherwise, but until somebody gets a lot more concrete with suggestions about *how* private will do it better, I'm most reluctant to sacrifice what we already have. It's not perfect, but it appears to me the less objectionable of the *currently available* evils.

One of the more interesting comments I received was, "Presumably you also want more money for the nationalist socialist space program." This is presumption in every sense of the word; I said nothing about space, and I neither said nor implied that I prefer "nationalist socialist" approaches in general. However, since the subject has been raised, getting humanity into space seems to me another of those things so important to our species' future that they simply need to be *done*, and I don't particularly care who does it or how. Given my druthers, I'd favor private, and I'm pleased to see that a number of companies have finally realized there is money to be made in space and are working to do so. So far, though, despite its limitations, NASA has a much longer record of actual accomplishment. Until we're farther along, I don't mind seeing *both* approaches trying, and may the best system win.

Parks and wilderness preserves are similar in that I think we need them, *as parks and preserves*, and as long as we have them, I don't particularly care whether they're public or private. If somebody has concrete, believable proposals for how they can be privatized *without destroying their value as parks and preserves*, that's fine with me. But vague assurances that It Will Happen are not enough. Simple faith that Competition for Dollars Will Make

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Everything All Right is touching but unconvincing.

Competition for dollars does an excellent job of stimulating innovation in manufacturing—but it also stimulates many businessmen to cut corners in everything from product quality to customer service to treatment of employees because they care far more about the bottom line than about how they maximize it. The proposals I've seen for selling off federal lands provided no reason to believe they would continue to be managed as parks or preserves rather than golf courses or shopping malls, and I'm pretty sure most buyers would see those as quicker and surer ways to profits. Sure, privatize the parks, *if* you can guarantee that they will still *be* parks, run at least as well as they are now run by the government—but don't tell me that clear-cutting and strip-mining them is better just because it's done by Private Enterprise.

The "public vs. private" debate, as it's often presented, seems to me yet another of those "all or nothing" fallacies: the mistaken assumption that everything must be done *this* way or everything must be *done* that way, when in fact this way might work better for some things and that way for others. Sometimes getting the job *done* is more important than doing it according to somebody's pet ideology. *How well a knife cuts* is more important than whose name is on the blade. ■

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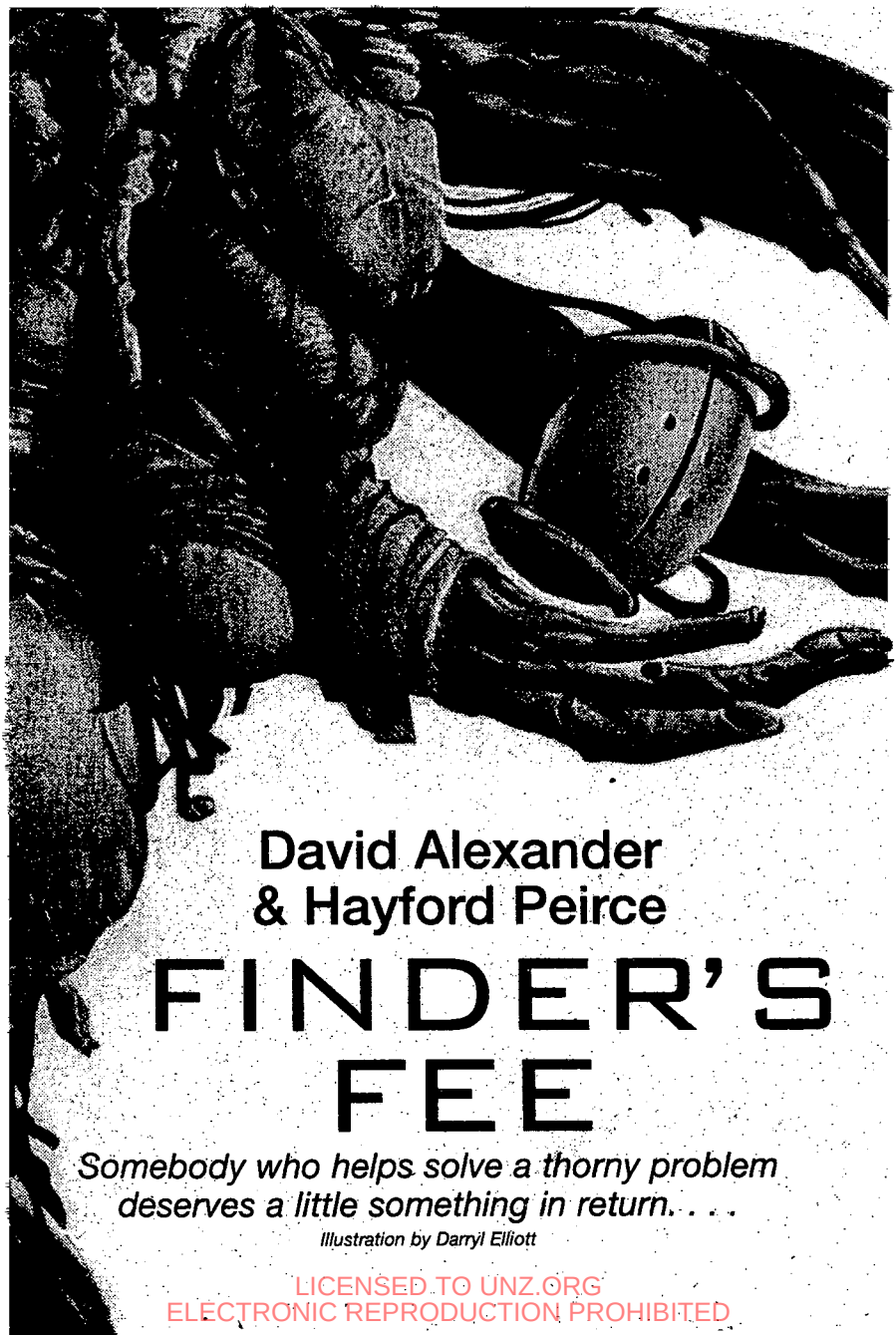

David Alexander
& Hayford Peirce

FINDER'S FEE

Somebody who helps solve a thorny problem deserves a little something in return. . . .

Illustration by Darryl Elliott

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All across Human Occupied Space planets continued to randomly lose congruency with nullspace, thereby isolating billions of human beings forever, but why should I care?

I was in the company of a beautiful woman, and the two of us were soaring on warm thermals high above the New Sonoran desert on the back of the biggest, gaudiest butterfly in the known Universe. The problems of interplanetary navigation should have been the farthest thing from my mind.

But I *did* care about the lost worlds, intensely.

After all, my life depended on it.

Only a few days before, the incomprehensible workings—or misworkings—of the currents of nullspace had unexpectedly washed me ashore here on New Sonora, the only habitable planet in the Icarus System, ninety-seven light-years from my intended destination.

And that was only the starter.

The logistics of interstellar commerce are stark. Either you voyage from star to star via nullspace or you don't go at all. Yes, you can try building yourself a craft capable of attaining a few percent of the speed of light, then spend eighty or ninety years guiding it to the next star system, hoping that something doesn't break down before you die of old age.

To my knowledge it had never been done, and I doubted that it ever would—and certainly not by me, a former senior facilitator and currently a neophyte star-freighter captain with little more to his name than a highly mortgaged spaceship and a cargo of almost certainly worthless crystalline blocks.

And if New Sonora fell out of congruency, as my intended destination of Charon IV apparently had, I wouldn't be able to make my next payment to the banker-surgeons of New Zurich, and they would, in consequence, refuse to transmit the reactivation code for the artificial pancreas installed in me as security for the mortgage on the *Venture*.

And I, Isaiah Howe, the one-time youngest senior facilitator in the history of Human Occupied Space, would be dead at the ripe old age of thirty-four.

Of course, even if New Sonora didn't fall out of congruency, I *still* needed the money for the payment. Or I would die. All of which made it easy to understand why I was a bit distracted.

"Do you like it?" shouted Rebona Myking over her shoulder from the lead saddle, her face lit by a radiant smile.

"It's terrific!" I called back. "The view is fantastic!"

It was, too. Not only the panorama of the improbable cactus-town and of the luridly colored mountains on all sides of its desert basin, but also the view of my companion's slim back and long auburn hair streaming almost into my face.

Forcing a smile, I tried and failed to banish all thoughts of just how far I was from being able to meet my upcoming mortgage payment.

"You're still brooding about the aliens and those damned crystals."

"Yes," I admitted, though the demands of the outlandish aliens the

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New Sonorans called Bagpipes were only making a bad situation worse. It was the crystals themselves that were at the root of my problems. I remembered the first time I had seen them in the cavernous warehouse back on the rain-drenched planet of Bountiful. . . .

My third trip as the master of my own ship had begun with reasonable promise. My cargo of prepaid blank data crystals, pharmaceuticals, Sytherian and Terran spices, and the master copy of an entertainment library licensed for duplication and distribution was destined for Bountiful, a planet whose star lay near the Edelweiss Drift. No system bordering the Drift had slipped away in the more than 600 years we had been using nullspace, so I was reasonably confident I would get to Bountiful and back.

Of equal importance, my consignee, the House of Rallingsback, had paid half the shipping costs in advance. It was only after I had released the cargo to the Rallingsback warehouse and was awaiting the balance of my money that I was informed that Ryseel Rallingsback, Lord of the House, had died eight days before.

"I'm very sorry to hear that," I murmured politely to the old man's sons.

The heirs to the House of Rallingsback, two pasty-faced sharpies with flaming red hair atop skull-like heads, pursed their lips lugubriously. Father's estate and all his assets, which now included my cargo, would, they explained, unfortunately be tied up in Probate Court for the next two years.

I was, of course, Reefal and Rastal Rallingsback advised, welcome to file a creditor's claim and wait for justice to take its course. Or, they smiled into the long, appalled silence, I could accept an extremely valuable consignment of high-grade crystals now lodged in this very warehouse.

Scowling, I let the Brothers Rallingsback lead me deeper into the gloom.

"Look," exclaimed Reefal, the marginally less skeletal of the two, gesturing at a carelessly piled heap of half-meter by half-meter crystalline blocks glimmering in subdued yellows, bright blues, and subtle greens, "one-and-a-half tons of a unique form of gemstone. It was Father's intention to cut them into sizes suitable for jewelry, electronic circuitry, surgical tools, and other devices. Unfortunately my brother and I have neither the time nor the experience to manage such a complicated venture."

Human space, of course, is overrun with gems, crystals, and gemstones from hundreds of planets. As far as jewelry is concerned, artificial diamonds and rubies indistinguishable from the real article are produced on a dozen worlds. And current manufacturing techniques have long since made obsolete most industrial uses for even the finest gemstones, synthetic substrates being far more efficient, uniform, and reliable.

I eyed the Rallingsbacks bleakly as I tried to keep from screaming aloud—more at my own stupidity than at their childish larceny. Their father had obviously been crazy to buy the crystals in the first place, and I would be equally crazy in accepting them as

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payment for the balance of the shipping charges. But what choice did I have? A bird in the hand. . . .

It took only a few minutes for the necessary documents to be signed, title transferred, and orders given to move the blocks to my cargo hold. I stormed out into the rain and had a quick dinner at a cheap portside restaurant. An hour later, wet and still seething with anger, I stomped across the rain-swept field and back to the *Venture*. There I found three sour-looking customs officials regarding the ship speculatively.

"Your purchase has been loaded?"

"Presumably. Why?"

One of them produced a paper. "Here is the calculation of the transfer taxes on the transaction. It comes to just under 19,000 credits."

"Very well," I said, knowing only too well that I had no more than six thousand to my name. "If you'll wait here, I'll get the money. Ship, lower the ramp."

Before they could object, I hurried inside, slid into my command chair, and snapped a toggle. The hatch whined shut behind me.

"Computer, what's the nearest human-occupied planet?" I demanded.

"Charon IV, fourteen light-years distant, sometimes called Dogwood."

"Then start getting us there in the next two seconds."

"There are three human beings standing by the passenger port."

"They're not human beings, they're *tax collectors!* Take us up—*now!*"

The lift-off klaxon sounded three thunderous tones. Thirty seconds later, shredding a thousand port regulations to ribbons, we lurched away from the field. As we tore through the upper atmosphere my hands clamped the arms of my chair in impotent fury. This whole miserable episode was yet another lesson in the difference between intellectual brilliance and practical knowledge. Any experienced ship's captain of even limited intelligence would have demanded payment in full before releasing his cargo to the consignee's warehouse.

But I, a man whose academic degrees and professional honors had once filled an entire wall of my luxurious office on Westerworld, had stood complacently by while the cargo was unloaded before payment was made. What was the old wheeze? A lesson learned is a lesson cherished. . . .

Five days out of Bountiful, somewhere in nullspace with barely enough money to refuel the *Venture* at her next planetfall, the computer roused me from a fitful sleep.

"I have a report."

I knew this could not be good news. "Go ahead," I muttered.

"Instead of exiting nullspace at Charon IV, fourteen light-years from Bountiful, we are about to enter the Icarus System, ninety-seven light-years farther along the Edelweiss Drift."

"*Dogwood* has slipped away?" I demanded, my voice tight. Only nine months earlier the 3,000 imperial grandees from Gaveltry who had incautiously accompanied their Autarch to Lowry's Landfall for his impending nuptials with the daughter of the Most Equal Elder, had vanished forever when the Landfall system had slipped from congruency. If Dog-

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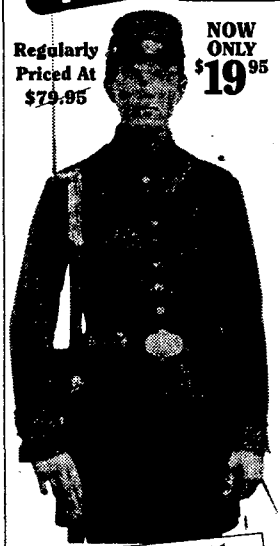

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wood was also gone, this would be the first time that two systems had lost congruency in less than a single Terran year.

You didn't have to be a senior facilitator with degrees in linguistics, economics, diplomacy, and advanced integration to discern a frightening pattern. Lowry's Landfall had been the fourteenth system to fall out of nullspace contact in the last fifty years, but it was the *ninth* to do so in the last twenty. In the previous two centuries we had lost only four.

If Dogwood had slipped away, then we were seeing a pattern that, if continued, would eventually spell the ruin of Human Occupied Space, as well as disaster for the empires of the six alien species with whom we uneasily coexisted.

"Ninety-seven light-years off course," I groaned. If Icarus too were to fall out of access by nullspace, then I would be marooned forever in this cosmic backwater. "Is Icarus within HOS? Can we refuel here?"

"Yes. It has one inhabited world: New Sonora."

Worse and worse: Sonora was the name of a blisteringly hot North American desert. If the planet's climate was similar to that of its namesake, New Sonora would not be an enticing planet. With growing concern, I threw myself into the command chair and tried to learn what I could of the approaching world.

New Sonora turned out to be both better and worse than I had feared.

Its gravity was a light .63 of the standard Terran norm, which meant that with my first steps down the boarding ramp I instantly felt as frisky as a teenager. And with a population of less than a quarter of a million human beings, landing formalities were comparatively few, which meant a welcome reduction in the landing fees, inspection charges, and all the other bureaucratic paperwork associated with more densely populated worlds.

Within a few minutes of establishing a communications link, the *Venture* had been directed to a barren patch of mountain-rimmed desert forty miles or so to the northwest of Saguaro, the planet's only metropolitan area. Half an hour after the ship touched down I was in an aircar moving away from the jagged chain of mountains north of the spacefield. A harsh white sun blazed out of an intensely blue sky. The profiles of the distant mountains that defined the great basin in which Saguaro lay were as sharp in the clear desert air as if they were within arm's reach.

As the view of the city grew larger in the aircar's bubble canopy, I glumly calculated that the probability would be high that a society with a small population apparently dedicated to living in harmony with nature and adapting local materials to human needs, would generate little or no business for a trader such as myself.

My only realistic hope of finding some commercial opportunity would be to discover a biological agent or "cactus" by-product that might have a unique value elsewhere in Human Occupied Space. I was not optimistic. On Earth, the only commercial by-

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products I had ever heard of that derived from the thousand or so varieties of cacti were prickly-pear jelly, tequila, and a variety of skin softeners, hardly the foundation for making my fortune, or meeting my next mortgage payment.

As the pale green cluster of succulents that made up the city of Saguaro grew closer, my eye was caught by a flicker of color against the deep blue sky. Moments later two small specks began to take on birdlike shapes, then suddenly became discernible as the giant butterflies that the ship's computer had informed me were one of the more beguiling aspects of life on New Sonora.

On the back of each scarlet-bodied butterfly sat a human rider as nonchalantly as Lady Godiva steering her horse through the streets of Coventry, though these riders were swathed in white to protect themselves from New Sonora's brilliant sun. As the aircar flashed past, they waved enormous sunhats.

Grinning, I waved back, my facilitator's mind automatically estimating the surface area of the butterflies' wings and running calculations to determine how such improbable creatures could possibly fly. When I factored in New Sonora's barely more than half standard gravity coupled with an atmospheric pressure nearly double that of Earth's, as well as the lift generated by the desert's thermals and the fact that this was a planet settled by genetic engineers who could as easily rewire an indigenous life form's DNA as a groundcar mechanic can change a flux coil, I understood how these fairytale creatures could soar so effortlessly through the New Sonoran sky.

I waved once more, then, as the butterflies fell behind, my thoughts again turned somber.

The butterflies were undeniably beautiful, but it seemed unlikely that I would be able to transport any of them alive to some distant zoo. Still, it was only early afternoon, time enough to check with whatever passed in Saguaro for a shipping agent to see if there was any hope of disposing of my cargo of crystal blocks on this uninviting and underpopulated world.

"Isaiah—what a curious name," Cotita Lazzeri said with mild surprise when I introduced myself.

"It's an old biblical name. I'm told it means salvation of the Lord." Cotita Lazzeri pursed her lips and ran gnarled hands through her helmet of matted gray hair.

"The lord? Which one?"

"Take your pick. It doesn't matter. It's just a name." I gestured at the small piece of brightly colored crystal that Cotita Lazzeri held in her hands. "What do you think?"

The New Sonoran factor put my sample down beside the holograms I had shown her of the shipment in the *Venture*'s cargo hold, then chuckled softly and shook her head.

"I'm afraid you're not going to be able to sell your cargo here, Citizen Howe. New Sonora is where it came from in the first place. Didn't you know that?" She broke off a thick, pulpy-looking piece of orange and

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white petal from a luxuriant flower growing in a pot on her desk and popped it into her fleshy mouth. As she chewed, the seams in her leathery face gradually relaxed into a euphoric smile. "Would you care for a piece? This is genuine Hillaton's Favorite."

I stared at Cotita Lazzeri in dismay. We were sitting in her small office high in the interior of one of the town's ubiquitous giant succulents. The room was dark, moist, and cool, with two small round portholes of triple-paned glass looking out on the Yakabee Mountains to the south. The floor beneath my feet was a very pale green, firm but faintly yielding. It was, like the irregularly shaped walls and ceiling, an integral part of the living "saguaro" itself. The cool air caressing my face carried with it a faint, almost imperceptible odor of exotic spices. I waved my hand, refusing the fleshy petal in Cotita Lazzeri's outstretched fingers. Now, if I were willing to transport unregistered euphorics. . . . But no, I was already in enough trouble without getting involved in drug running.

"Are you certain my crystals are from New Sonora?"

"Oh yes. If you like, we can run them through a spectroscope, but that will only confirm what I've told you. The colors and structure are definitely those of Carson's crystal. They're unique to this world, and absolutely worthless."

"Doesn't their very uniqueness confer some value?"

"Not when there are hundreds of tons of them available from Xerxes's mine and not when there's nothing they're good for except their pretty colors and any decent fabricator can make you glass baubles that look twice as nice. You might as well try to peddle our sand and rocks."

I nodded morosely. "There's no practical use for them at all?"

"Other than junk jewelry? Not to my knowledge." The factor stuffed another petal into her mouth and chewed voluptuously.

"But I've got a ton-and-a-half of the stuff sitting in my hold. Certainly there was a reason why it was mined and shipped."

Cotita Lazzeri smiled blissfully and for a moment I caught a tantalizing glimpse of the once-beautiful woman trapped within this leathery-skinned creature of almost indeterminate age and sex.

"Oh, Xavier Xerxes had a reason. I'm certain your consignee on Beautiful, or wherever, must have gotten it from him. Xerxes the Zany we call him here in Saguaro. He's a local character, an offworlder from Kingfire who's convinced that there must be *something* on New Sonora that will make his fortune. He's the kind of man who believes that someday he'll find a pot of gold at the end of the rainbow, so long as he just looks hard enough. He's been looking now for sixteen or seventeen years with no results, except for this stuff." The factor shrugged and handed the crystal back to me. "For the last year or so he's been trying to get people interested in these things. He's got a mine out in the Hormagaunts. Obviously, he sold your load to some sucker offworld. God knows what Xerxes told him

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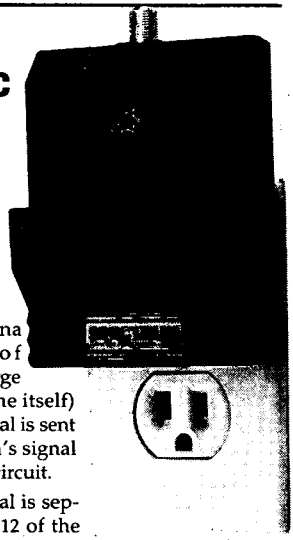

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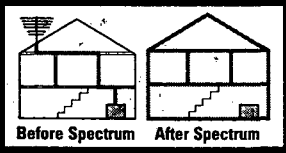

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they were good for. He'll be using the money, I suppose, for research.'"

"Research on the crystals?"

Cotita Lazzeri laughed. "What else? I've heard that he's managed to talk some Museum of Man scientists into coming here to examine them." She gestured indulgently. "What a joke! He's convinced himself that they must have some secret capabilities just waiting to be discovered." She plucked and ate another petal and her eyes grew even vaguer.

"What you're telling me is that no one here sees any value in my crystals except Xavier Xerxes and he has no reason to buy them."

"Exactly. He's already got a mountain full of them." The factor's head wobbled uncertainly.

"Do you think there's any use in talking to him?"

"He's nothing but a hard-luck prospector looking for a pot of gold he'll never find. I wouldn't waste my time if I were you."

With no more information to be gained, I bounced to my feet in the light gravity with the appearance of far more exuberance than I actually felt and left Cotita Lazzeri to her flower petals.

"Does it take long to learn to ride these 'flies?" I asked, speaking into Rebona Myking's right ear at our cruising height of about a thousand feet. I felt detached, isolated from the world below. Except for the soft hiss of scented wind whispering past my ears the sky was as silent as the noiseless vacuum of space.

"Only a few hours. This little bar in front of my saddle controls our course. The biogeneticists who settled the planet modified the 'flies' skeleton to make a bone-like joystick growing out of their spine. When you move it, directional nerve impulses are sent to its brain, not that the 'flies' brains are very big, but they're large enough to let them take us where we tell them to go." She tossed her head and laughed gaily. "*Usually,* that is. Sometimes they have a mind of their own."

A few minutes later I saw what she meant. The butterfly went into a long slow spiral that seemed to be centered on a thick cluster of giant cacti in an otherwise barren stretch of rocky desert. The 'fly's enormous scarlet wings, filigreed with an intricate pattern of green and blue, fluttered once, then became rigid as we drifted lower. Although I was securely strapped into the leather saddle that sat athwart the bony blue crest running down the middle of the 'fly's back, I involuntarily clenched my knees around the saddle.

"Don't worry," Rebona assured me, "the saddle is bonded to the carapace by a natural resin made from dead 'flies' connective tissue. It *can't* fall off, and neither can you."

"Is she going to land on that *cactus?*"

"The narco-flowers are a treat for the 'flies as well as for humans—it's no use trying to steer her away. We're just going to have to be patient until she's drunk her fill."

I sat back and tried to enjoy the view as we glided down to the spine-studded plant. The genetic tinkering

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with the local cacti by the planet's first settlers had borne spectacular fruit.

There were two kinds of giant "cacti" on New Sonora. One was what our butterfly was now homing in on, the Demon Lover, a huge cone-shaped plant on which grew the prized narco-flowers. The other was what the natives perversely called "saguaros," although the local variety bore as much resemblance to the Terran cactus as a goldfish does to a great white shark.

I had gotten a good look at the so-called saguaros on my aircar ride in from the landing field. Except for a few industrial buildings for such things as generating power and processing toxic materials, the city of Saguaro was almost entirely composed of the plants. All of the region's inhabitants lived in the barrel-shaped succulents, although calling them "pumpkins" would have made far more sense than "saguaros."

If you took a giant green pumpkin, hollowed it out, put the top back on, and then carved away at its sides until you had eight widely spaced staves curving up to fuse together into a single massive green capstone, you'd have a New Sonoran saguaro, except that in this case the capstone was broad enough, and thick enough, to host a game of tennis.

While awesome, their gigantic size was easily understandable. Even in the far heavier gravity of Earth there were giant sequoias and eucalypti well over 300 feet in height. And the ship's database told me that each of the saguaro's eight staves was anchored to the desert floor by massive networks of giant roots. In New Sonora's lighter gravity, creating these cacti would have been child's play for the two or three generations of eccentric genetic engineers who had amused themselves by growing 20-foot butterflies. And as a final refinement, they had induced titanium-precipitating microbes to live in a symbiotic relationship within the cactus staves. Not only did this help support the gigantic plants, it also enabled the locals to smelt the plant for profit when it died. True ingenuity!

Now practically the entire population lived inside plants that even in the blast-furnace atmosphere of New Sonora were cool and moist and that, except for the cost of installing utility runs, elevators, and ventilation systems, were essentially free.

The Demon Lover cacti were just as tall as the great saguaros but were shaped like knobby green cones. Growing from bases a hundred feet in diameter, their bodies tapered to a blunt, rounded summit almost hidden beneath a dense crown of yellow and orange blossoms.

The nearer we drew to the monstrous Demon Lover plant, the more impressive it became. In addition to having ordinary needles like Terrestrial cacti, this succulent's tough, fibrous surface also sported a veritable forest of fronds, limbs, and branches, as well as a host of parasitic vines and plants.

I grew increasingly uneasy as the flowers drifted closer. Was the 'fly going to land directly on one of the enormous blossoms or merely hover above it? Either seemed equally dan-

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gerous. An unexpected thermal could easily smash us against a foot-long needle. And if the 'fly tumbled into the plant, the spines would rip us to shreds.

Rebona Myking didn't seem to be worried by the prospect. She merely gestured at the huge yellow flower upon which the butterfly was now slowly settling.

"The Demon Lover's narco-flower contains a powerful aphrodisiac and euphoric, at least for human beings. At wedding ceremonies the bride and groom wrap themselves in sheets of petals and are carried by their guests to the nuptial banquet. Later, after ceremonial toasts with petal nectar, they're led to the honeymoon suite where the bedsheets are composed of mats made from the petals. It's a very powerful experience," she added in a surprisingly harsh tone. "Even the Bagpipes seem to be affected by the damned flowers. Frankly, I'm surprised they live in a Demon Lover the way they do."

"You seem to know a lot about these things," I ventured cautiously. "Have you tried them?"

Rebona Myking was silent so long that I was certain I had offended her. Finally she spoke without looking at me.

"My husband's an ethnologist. One of the reasons we came here was so he could study the courtship and wedding rituals of the New Sonorans. So, yes, I *did* try it. Purely as scientists, he said. Unfortunately Ross is one of those people who overreact to it and he's become an addict. I haven't seen him in over nine months now."

"You mean he's given up a beautiful woman like you for . . . for a *flower?*"

She nodded curtly. "So it seems."

"There's no treatment for this addiction?"

"If you want to be treated. But like most addicts, he *doesn't*. I've been waiting for him to admit that he needs help." She shrugged almost imperceptibly. "I'm going to give him another three months. After that. . . . What about you? Do you have a wife somewhere?"

"No, not anymore."

"Was it terrible, your—divorce?"

"It's never fun, I guess, is it? I had some business problems and she couldn't handle my—my change in circumstances. It's a long story."

"I shouldn't have asked," Rebona said apologetically. "Let's forget both of them and just enjoy our ride."

A moment later the 'fly withdrew her proboscis from the flower, revved up the flapping of her wings, and fluttered us back up into the sky.

As I watched the narco-flower dwindle beneath us, I wondered gloomily if what had happened to me on my purported way to Charon IV meant that all my future flying would now be confined to the backs of butterflies. . . .

Rebona Myking had approached me in the best restaurant the metropolis of Saguaro had to offer. It was called the Belle Vue and it lived up to its name. It was at the very top of what looked like the tallest living thing in the entire Universe. Seven of the massive staves rising from its geometrically precise circular base held

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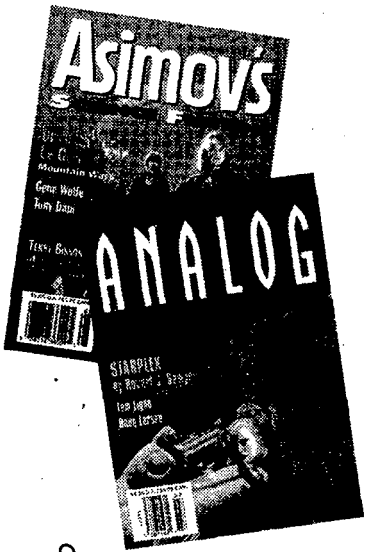

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apartments. In the eighth, in addition to offices and stores, an elevator serviced the thick capstone where the Belle Vue had been hollowed out of the living plant.

Far above the desert floor, the restaurant-tavern afforded a 360-degree panorama of hundreds of square miles of orange, scarlet, and red desert, expanses of huge cacti, and four ranges of jagged olive- and rust-colored mountains. In spite of the hellish sun beating down from the cobalt sky, the restaurant itself was dark, cool, and moist, an oasis in the middle of a Dantesque landscape.

As I sat sipping pale blue beer and sampling a tableful of tiny dishes of New Sonoran *haute cuisine*, I reflected glumly that with every passing hour it was becoming more likely that I would have to tap my emergency cache of Universal Credits just to get enough fuel to escape this world. It was certain that the useless crystals wouldn't power the *Venture*'s engines.

"Excuse me, are you the gentleman with the crystals for sale?"

A pretty girl stood looking down at me, or at least what I thought *might* be a pretty girl, for her face was half-hidden by the floppy brim of her enormous sunhat.

I rose. "Yes, I'm Isaiah Howe." I pointed to the empty chair across from mine. "Please join me."

She paused, smiled faintly, and removed her hat. I decided that she was almost certainly not a native of New Sonora. Her skin was far too fair, almost a milky white, while that of the locals was uniformly tanned a leathery brown. And her light gray eyes sparkled with a liveliness and intelligence that was noticeably absent from the faces of the petal-chewing New Sonorans.

"I'm sorry," she said in an accent that was pure Standard, "but I can't at the moment. You see—" she nodded toward the broad expanse of window behind me "—it's actually someone else, outside, who'd like to speak to you about the crystals. He . . . didn't feel comfortable coming in. Could you come outside and meet him? He's just out on the landing deck."

"My pleasure," I said warmly; if someone wanted to buy my cargo I'd walk across the New Sonoran desert at high noon to meet him. "Lead the way. Perhaps later you'll join me for a nightcap."

The alien honked at me, then he burped like a sated tyrannosaurus, and finally he produced a sound that was a passable imitation of a high-speed collision of four or five ground-cars.

"Can you make any sense of that?"

Rebona Myking sighed. "It's difficult enough to translate even with computer analysis and enhancement, but I'll try."

"I thought I knew every alien species in Human Occupied Space but I've never seen anything like *that*. What *is* it?"

"Here on New Sonora we call them Bagpipes."

"Because they look like bagpipes or because they sound like them?"

"A little of both."

I turned back to the alien. It looked

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like a jury-rigged bundle of hoses, tubes, tentacles, and rubber pipes that were anywhere from a quarter of an inch to two inches or more in diameter, with lengths as varied as their thickness. The Bagpipe's colors ranged from pewter through a dark silvery charcoal. Its body was neither vertically nor horizontally symmetrical. Instead, various hoses appeared at random locations, some undoubtedly serving as fingers, hands, feet, ears, noses, and mouths. Half a dozen tiny aprons of various gaudy colors were strapped to tentacles in no apparent order and were its only articles of clothing.

When I was finally able to tear my fascinated gaze from the Bagpipe I saw that Rebona was studying the display panel of a small hand-held computer connected to a wire leading to her ear. She pursed her lips.

"He says he'd like to discuss the crystals with you and requests that the three of us take a short ride to his quarters."

"Fine," I agreed immediately, heedless of the outlandishness of the alien beside me. "Let's go." I *needed* that sale!

We headed for an aircar at the edge of the landing area, the alien moving with surprising grace. The ten or fifteen hoses that served as its feet shuttled in a complicated rhythm as if the Bagpipe were a strange breed of circular centipede that could move in any direction without having to rotate its body.

The alien fitted his flexible body into one of the seats without apparent discomfort. "It's actually my aircar," Rebona Myking explained, "but he insists on flying it." She grinned ruefully. "Who's going to argue with anyone who looks like *that?*"

In a swift blur of motion two of the Bagpipe's smaller tubes pecked at the craft's instrument panel and moments later we were cruising 900 feet above New Sonora's desert. I studied the alien carefully as we flew along but it was impossible to guess which of its appendages might serve as visual receptors.

A few minutes of flight took us southeast across a dozen miles of desert. None of us spoke as the aircar descended toward a large solitary Demon Lover cactus. Its crown was studded with enormous orange and yellow blossoms, some of which were four or five yards across. The aircar moved towards a dark opening some fifty feet below the plant's apex and settled to a silky halt on a ledge just outside the mouth of a tunnel.

The light inside the chamber was dim, but the Bagpipe seemed to have no problem finding his way and we trotted along behind him across the room's spongy, resilient floor. One dark tunnel led to another, and eventually we came to a small tubular shaft in the center of the plant. The Bagpipe pressed a button with one of its trunks and a chain of single-person transport disks slowly moved down inside the tube. One by one we boarded the disks and an eternity later were deposited deep within the huge succulent.

From out of the gloom two more aliens appeared and immediately began honking at their comrade. I

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turned to Rebona's shadowy silhouette.

"What're they saying?"

"I can barely figure what they're saying when only *one* of them's talking—with two or more it's hopeless. The meaning of their communication units is contained as much in which tube emits the sound and in the accompanying gestures as it is by the sound itself. My computer pack has a neural-net visual system that I focus on the Bagpipe who's talking. The AI uses a preloaded vocabulary to determine which of the tubes is generating the noise and making the gestures, and then it gives me a rough translation with a choice of vocabulary options."

"Options?"

"Almost nothing *but* options. Most of my job consists of studying the possible alternative meanings based on the context of the conversation, then I assemble a coherent, meaningful exchange as a gestalt. There's almost no word-for-word equivalency between the Bagpipes' language and human speech. For now we'll just have to wait until they decide which one's going to speak to us before I can tell you anything about what they're saying."

We waited more or less patiently until one of the aliens, apparently their spokesman, moved forward. Rebona activated her computer and again inserted the plug into her ear. The alien, whom I dubbed Tall And Thin because he was both taller and thinner than either of his companions, began another of his hooting, honking monologues. When he come to a gurgling conclusion, Rebona turned to me and hesitantly began her translation.

"They seem to be . . . agitated by your cargo of crystals. They've learned about it, apparently over the net, and they say that it's urgent, or important, or vital, something like that, that you give them up."

"Give them up? To whom? To them? Do you mean they want to buy them?"

"I'm not really sure. It may be they want actual physical possession of them, or it may be they want the crystals put back where they originally came from." She grimaced. "I'm afraid it's not very clear."

"Can't you ask them for clarification?"

"Communicating with the Bagpipes is almost entirely a one-way process. I simply don't have the right equipment to speak their language beyond getting across a few pidgin phrases. It's the equivalent of trying to learn something technical from a human nullspace engineer if you limit yourself to only a vocabulary of a hundred words like 'yes,' 'no,' 'stop,' 'go,' 'good,' and 'bad.'" She turned back to Tall And Thin. "I have a basic phrase for 'I don't understand.' I'll try that."

Rebona pressed keys on her computer and its speaker issued a brief series of hoots and honks. The Bagpipes remained motionless for several seconds, then engaged in another three-way dialog. Finally Tall And Thin spoke again.

"Well?"

"I'm still not sure," she said, shaking her head. "What I *think* I'm getting is something about it being for-

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bidden or taboo or an insult or wrong or dangerous for you to have the crystals, or for the crystals to be taken off-planet, or for the crystals to be used or modified or sold; and that the crystals must be released by you, probably into their custody, to be properly disposed of or transferred or worshipped or venerated or protected."

I glared at the Bagpipes. "Why are they so concerned by my crystals? Are they religious artifacts, or necessary for a mating ritual, or used for medical purposes, or *what?*"

"I don't know. I simply don't have enough vocabulary to ask that kind of question. I'll tell them again that you don't understand, but I think they'll just repeat what they said before."

"Can you tell them I'll consider their request?"

"Yes, there's a phrase that's roughly equivalent to 'I need time to think.'"

Rebona tapped more keys, her computer emitted a desultory hoot, and then we turned and headed back to the transport tube. Neither Tall And Thin nor the others made a move to follow us. Once we were in Rebona's aircar and on our way back to the restaurant I tried to elicit any additional information that might help make sense of all this.

"You seem to be the local expert on the Bagpipes. Where did they come from? What are they doing here?"

"I'm really not that much of an expert, I'm afraid. I'm actually an eco-biologist from the university on Granger IV. My department had heard about this planet's genetically modified cacti and wanted to see if we could create similar biological housing units for other ecological systems. My husband wanted to do his own research, so it seemed the perfect trip to take together. I've been here about a year and a half now. About six months ago the Bagpipes showed up and I seemed to be the only person on the planet who took any interest in them."

"*A new alien species?* And no one's *interested?*"

"Well, for a while they were a minor curiosity, but when communication with them proved so difficult everyone else lost interest. You've got to remember that this is still pretty much a frontier world and any field of study without a practical application is discouraged or ignored. And, of course," she added with a bitter edge to her voice, "it's a planet almost entirely populated by petalheads. Most of the time everyone here's too bent to see beyond the end of their nose."

"They do seem a trifle . . . relaxed," I agreed. "But you . . ?"

"Because of my husband, I also have something of an ethnological background. I managed to modify some of the equipment we'd brought for research and eventually I was able to communicate with the Bagpipes after a fashion. By now a professional xenologist with the right equipment would be projecting a holographic simulacrum of a Bagpipe waving precisely the right tubes in the right order as part of the translation process. But without the equipment or training, I just have to fumble along."

"Don't be so apologetic! I'm astonished you've accomplished as much as you have—communication with *any* other species is always extremely

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difficult. How many of them are there?"

"You mean here? Oh, half a dozen or so that I know of. They came in a single small ship."

"Where do they come from? And why did they come here?"

"More mysteries. All I can gather is that they're from somewhere way beyond HOS and that they may or may not be part of an empire. And I think they have their own way of getting around nullspace, one that's a lot more certain than ours."

"*Really?*" More and more interesting. Nullspace is peculiar. Sometimes you can go from A to C, but not from A to B, even though it lies directly between the two. To get *there,* you first have to go to D, then backtrack. If the Bagpipes had a new and better way of navigating nullspace . . .

"What do they want here on New Sonora?"

"It definitely has something to do with those crystals, but I'm not sure exactly what. They told Xavier Xerxes pretty much what they just told you, that he should leave the crystals alone, that the sale of the crystals was forbidden."

"Sale? Did they really use that word?"

"Well, no. Distribution, sale, dispersion, dissemination—it might be any one of them."

"Do you think Xerxes understood what the Bagpipes meant any more than I do?"

"I don't think he *cared* what they meant. But I'm only guessing. You could always ask him yourself."

"I think I will. Will you be my guide? How about tomorrow morning?"

"I'll pick you up at nine," she said, nodding vigorously, as if she were glad to have something to do, just as we dropped down to the deck of the cactus/restaurant where I had just met my first Bagpipe.

Xavier Xerxes was clearly a man with an obsession. It was equally clear why the locals called him Xerxes the Zany. He was tall and gaunt, with a long, lustrous, milky beard. Enormous glittering green eyes smoldered beneath almost non-existent eyebrows. In the middle of his flowing white beard was a large red circle, as carefully crafted as if it had been laser-printed there earlier that day. What purpose it served was not immediately obvious. All in all, he looked like a particularly mad biblical prophet.

"So you're interested in my crystals, are you?" Xerxes muttered suspiciously, his glittering eyes fixed intently on one of my old business cards. "What exactly do you want with them?"

Xerxes, Rebona Myking, and I were in a hideous dank chamber hollowed out of the Hormagaunt Hills just north of the spaceport. It hadn't been cleaned since the day it was dug and we were perched on makeshift pieces of furniture that hadn't been dusted since the turn of the century. The walls exuded a stench powerful enough to be used as insect repellent against the man-eating triple-teeth on Think Again.

"I've got a shipload of crystal, so I thought it might be a good idea to find out what it's good for."

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"You *admit* it, then? You want to find out what I've discovered about my crystals so you can make your own fortune from them."

"I've only got the one shipload. Certainly not enough to threaten your position with a whole mountain at your disposal. After all, you control the source of supply. Still, I'd definitely like to find some way to sell them. What have you learned, if I'm not asking you to reveal trade secrets."

Xerxes's incandescent gaze moved from me to Rebona Myking, who squirmed uncomfortably beneath it, then back to me.

"All right. It's no secret, I suppose. At least most of it isn't. Here, follow me."

We trailed Xerxes through the back of the cave into a narrow passageway hewn from the mountain's interior. "The main diggings are up this way." A hundred yards into the mountain the tunnel widened into a good-sized chamber with a ceiling at least twenty feet above our heads. "Here," said Xerxes, gesturing at a glittering rock face of yellow, green, and azure crystal identical to that in my cargo hold.

I tried to stifle my disappointment. "This is where you've been doing your research?"

"Yes. Anyone on the planet will tell you the crystals have got some damned unusual properties. I've bombarded them with magnetic fields and high-voltage electron beams with amazing results. In fact—" Xerxes's mouth snapped shut and he glared at me defiantly, as if I had almost tricked him into revealing too much.

"What sort of results?" I prompted.

"Well . . . hallucinations, I guess you'd say, astral displacements, far visions, OBE's, Dunesian epiphanies, stuff like that."

"No teleportation or spontaneous human combustion?" Rebona asked sarcastically.

"I don't understand how nullspace generators work either, lady, but they *do*, don't they?" Xerxes jabbed a long, bony finger painfully into my chest. "They're *real*, all right, I just don't have the quantitative data yet. And the results vary from time to time. You'd have to see them for yourself to understand why they're so remarkable."

I pursed my lips as I considered his words. "If you pass a laser beam through a crystal impressed with a holographic etching you'll see a three-dimensional image in front of you. It's totally illusory—but you still see it."

Xerxes shrugged. "Explain it however you like. All I know is that it works."

"But you can't make the effects reliably repeatable?"

"Not yet. It's all hit or miss—so far." Once again his mad eyes glared at me. "But I'll get it, sooner or later I'm *going* to get it. And when I do, I'll be the richest man in the sector!"

"Who else knows the crystals have these properties?"

Xavier Xerxes uttered a harsh bark of bitter disdain.

"You think the petalheads care? They're all so stupefied from chewing on those damned flowers they wouldn't notice if my crystals picked them up and threw them over the tops of their Demon Lovers!"

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"Some of them notice," Rebona interrupted. "Everyone in Saguaro says you're bringing in experts from the Museum of Man to help you."

"The petalheads are saying that?" The mad green eyes grew crafty and Xerxes lowered his voice to a pensive whisper. "Well, maybe for once they're right about something."

"You think they can help you turn the crystals into some sort of entertainment device?" I asked.

"I didn't say that!" Xerxes glared suspiciously.

I shrugged. "It seems obvious. What else could you use them for?"

"I guess you'll just have to wait and see, won't you?"

I nodded. "But remember," I reminded him, "I have a load of the crystals, too. I want to see you succeed as much as you do." I turned towards the tunnel, then paused. "I understand you were approached by the Bagpipes," I added as if it were an unimportant afterthought. "What did they want?"

"The Bagpipes? More damned nonsense!"

"What do you mean?"

Xerxes laughed. "They want me to give up my project—if I'm understanding them right." He gave me a hard stare. "If you've got hold of my shipload of crystals why don't you go talk to the Bagpipes? Maybe you can get *them* to tell you why they're so interested in them."

"As a matter of fact, they've already contacted me, but they didn't seem to make much sense—something about disturbing the crystals being forbidden. Do you think we should take them seriously?"

Xerxes twitched his lips contemptuously. "This is a human planet, Mr. Senior Facilitator Howe, run by *our* laws, not theirs. The crystals are legally ours. I don't *care* what they want."

"Reasonable enough, but we don't have any idea of what the Bagpipes can do."

"Here on New Sonora there are a dozen of them and a quarter million of us." He hefted his beard's luxuriant length and waved its bright red circle at me. "I'm from Kingfire, a Dominie Second Class from the Seventeenth Cube Removed. I would have thought a big-brain ex-facilitator like you would have known that. Which means I'm not afraid of a collection of half-sentient garden hoses. *Nobody's* taking my crystals away from me!"

Half-blinded by the late-morning sun, Rebona and I stood blinking beside the adit that led to Xerxes's mine. The prospector's battered blue aircar lay in the windswept dust not far from Rebona's.

"Would you like to go butterfly riding?" she asked hesitantly.

In the full glory of New Sonora's blazing sun, Rebona was more than just pretty—she was beautiful. And until I came up with some other idea I certainly had nothing better to do.

"Absolutely," I said.

The butterfly stable was tucked away in the circular space inside the base of a medium-sized saguaro on the city's outskirts. Beneath a huge gauzy awning seven or eight of the enormous butterfly-like creatures lay torpidly in the inky shadows, their

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blue and green wings wrapped around scarlet and blue bodies so that only the tips of their torpedo-like heads were visible. From each of the motionless beasts a dull red tube protruded into a stainless steel cask. Their huge yellow and black eyes seemed as inanimate as dinner plates.

"Sugar syrup," explained Rebona. "As long as it's supplied, the 'flies won't move an inch."

A leathery-skinned New Sonoran, who seemed nearly as torpid as his colorful charges, reluctantly emerged from a leg of the cactus and lackadaisically manhandled the nearest butterfly away from its feeding station. As its long proboscis slowly withdrew into its head, the 'fly's wings began to unfold. Tapping it on the side of the head with a heavy orange prod, the butterfly handler maneuvered the creature away from its companions and through an opening in its huge mesh cage. Rebona Myking took me by the hand and led me up onto the butterfly's surprisingly sturdy back.

When we returned to the stables several hours later I watched appreciatively as Rebona climbed gracefully down from our mount, her long slim legs filling her trousers to perfection. The air was almost too dry to feel myself sweating, but I knew that in this terrible heat we must have been rapidly evaporating our liquid reserves.

I waggled a finger in the general direction of the spaceport. "Rather than offering you a glass of the terrible local beer, if you'll fly me back to my ship I think my galley can dispense something more civilized."

A few minutes later we entered the *Venture*'s tiny salon and Rebona sank into my comfortable old red leather chair. The galley produced tall glasses of lemonade for each of us.

"I like your ship," she said warmly. "It's very . . . homey. But don't you get lonely out in space all by yourself? What if something broke down?"

"That's something spacers don't think about, let alone say aloud. And in theory the ship's smart enough to repair almost anything that goes wrong, as long as the problem is with the equipment."

"What else could it be?"

"The problem could be nullspace itself."

"You mean planets slipping away?"

I nodded. "If entire *systems* can fall out of congruence, why not spaceships? I personally think there's now enough statistical evidence about missing ships to indicate that sometimes that actually happens."

Rebona frowned into her lemonade. "That's why I don't like traveling very much. Suppose you got stuck on some really terrible planet like Piggoty's Place or Sandalstone III? That would be awful!"

"Yes," I agreed, perching myself carefully on the arm of her chair. "It's a sobering thought. But what about your own profession? I'd bet that in every system that's ever slipped away there's been at least one or two visiting scholars who've been trapped there forever."

Rebona uttered a little sigh. "There's actually a marble plaque at

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the Peabody Museum at Harvard with a whole list of them. They update it regularly."

"I know—I've seen it. And, unfortunately, that's the least part of the problem."

"How do you mean?"

"Unless you live within a planetary system that you never, ever intend to leave, there isn't an investment or bank account anywhere in HOS that's completely safe."

"There are the UC's. They're *guaranteed* safe."

It was true. Universal Credits were guaranteed to hold their value no matter how many systems fell out of nullspace. Centuries before, when the first systems began to slip away, the central banks of Earth, Telos, and New Zurich had agreed to jointly issue a currency called Universal Credits. All three planets would have to fall out of congruency simultaneously for the credits to be rendered worthless. Like everyone with any sense, I kept my own modest supply of emergency funds in UC's.

"Small change," I pointed out. "That guarantee is limited to a maximum of a million credits per customer. Fine for individuals, but worthless for *real* business. The effect on commerce of planets slipping away is already massive, and it's getting worse."

"Well, you're a facilitator. I suppose you ought to know."

"*Ex*-facilitator—there's a considerable difference between the two."

"Why are you an ex, if I'm not being nosy?"

"I don't mind, but it's a long story."

Nineteen months earlier I had been on Mathison's World on the opposite side of Human Occupied Space, about to conclude the most important transaction of my career. Senior Facilitators are basically polymaths trained to recognize and correlate obscure relationships between vastly disparate types of information. We can discern, extrapolate from, and, of equal importance, articulate, apparently non-existent relationships.

In consideration of a suitable fee, we can reconcile seemingly irreconcilable pieces of data to often arrive at solutions for everything from quarreling spouses to warring planets. For certain types of adjudicating and expediting within specifically defined parameters, only licensed facilitators can legally charge a fee. And, of course, only licensed facilitators are given any credence in the first place by the major businesses and governments with which Human Occupied Space's several hundred Senior Facilitators normally deal.

Purely by chance, I had been gifted at birth with certain talents that years of training had eventually brought to fruition as a Senior Facilitator. And as befit my biblical name of Isaiah, the motto on my letterhead and business cards read: *Come Now, and Let Us Reason Together....*

But reasoning together on Mathison's World had led to a tangled nightmare of a disaster for which an arbitrator on Westerworld had designated me the official scapegoat. When all was said and done, my license had been suspended for five years, just at the time that all my savings and in-

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vestments vanished when the financial haven of New Gibraltar fell out of congruency.

I had a choice: I could take every last penny I could scrape up and appeal the Arbitrator's decision knowing that the chances of overturning the judgment were slim at best, or I could take my few remaining assets and put my skills to use in the interstellar shipping business.

Eventually, by leaving my pancreas as collateral with the flint-hearted bankers of New Zurich and having it replaced with an artificial one programmed to require servicing within two months of every annual payment date, I was able to purchase a mortgaged spaceship in reasonable working order.

Meeting my mortgage payments subsequently took on an urgency that the average borrower seldom experiences. . . .

Rebona Myking smiled encouragingly. "That doesn't seem—" but she was cut off by two loud clangs from the *Venture*'s hull.

"Ship, what's that?"

"Someone has just pounded on the hull with a metal implement."

"Thanks for being so informative," I grumped, and strode to the main hatch. Looking up at the monitor I saw three Bagpipes standing before the lock.

One was Tall And Thin. The other two were strangers. The lighter colored one I dubbed Almost Gray. The third had a peculiar tube in the middle of his body that was thicker and more muscular than those of the others. He became Trunk Like An Elephant.

"Look who's here," I called to Rebona, opening the hatch for the aliens.

The Bagpipes brushed past me like visions from a nightmare and headed for the control room. After a moment's hesitation they shuffled to the main computer's I/O ports, pulled lumpy crystalline devices from their aprons, and, using seven or eight of their manipulators with blinding speed, began to plug hair-thin filaments from their contrivances into the computer's access ports.

"What are they doing?" I asked Rebona, but she was as confused as I was and only shook her head. "Ship, defend your integrity by whatever means necessary if it looks like you're being endangered."

"Noted."

Rebona tapped at her computer's keyboard, then stood scowling at Tall And Thin's reply.

"He says they're preparing to talk to us. They evidently think they can set up a better translator by connecting their equipment to your ship's computer."

"If they don't destroy the Matrix in the process," I muttered uneasily, inching forward to get a better look at what the Bagpipes were up to. A few minutes later Almost Gray held out two circular bands of a milky crystalline substance that were wired into the *Venture*'s I/O ports through a web of dozens of tiny tendrils. Tall And Thin hooted at Rebona and appeared to be motioning for us to approach.

"He says they're ready or done or that we should proceed, something like that."

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"I'll go first," I said with no great enthusiasm. "If my head blows up . . ." I shrugged, unable to think of appropriate instructions.

I pulled the band over my head. The material softened and adjusted itself to my cranial contours and shortly my eyes and ears were completely covered. An instant later I found myself floating in the vastness of space, adrift in the middle of a grayish cosmos dimly lighted by a billion distant suns.

Slowly, more details began to take shape. Far below I saw a river winding its way across plains and through canyons until it disappeared into the misty distance. Just above the far horizon were two larger stars; stretching between them I could discern a tiny silver thread.

I had just formed the thought of wanting to examine the river more closely when my point of view zoomed downwards until I was floating barely a few feet above its swirling, quicksilver surface. Then, with only the slightest mental flicker, I was able to move along the river at dizzying speed.

Rapids, waterfalls, whirlpools, dams, lakes, reefs, rocks, cliffs, and canyons flashed past until the river finally emptied into a broad, placid sea. I paused for a moment, then began to rise. The ocean dwindled beneath me, the horizon grew curved, and within seconds I was far above what was now a planet hanging in space.

Turning my attention to the millions of distant suns, I realized that if I concentrated on any particular pair of them I could see a tiny silver thread running between them. Was this some sort of psychological visualization of routes through nullspace? I peered in all directions until I found a thread that seemed wider and thicker than the rest, then soared over to examine it.

Once again I found myself hovering above a river.

If the first had been a wild, barely tamed torrent, this one was a placid, heavily traveled, commercial artery. On the river were . . . *things*. They were, in a sense, ships, a weird cross between houseboats, ocean liners, and Tom Sawyer's raft. That's not, of course, very descriptive, but what I was seeing was not the factual image of a real object but only my poor human brain's attempt to make sense of the alien signals being pumped through my optic and auditory nerves.

In addition to the boat-like objects there were other things—presences? animals? *something*—in the water around the ships—silvery-gray, rounded, oval blobs. While unable to determine exactly what they were, my intuition told me that these were living creatures in some sort of symbiosis with the ships, guiding or pulling them down the river, perhaps in a larger sense actually moving the ships through nullspace between the stars.

Was all this a representation of how the Bagpipes navigated their interstellar craft, how they avoided the nullspace dangers that had plagued humanity? I felt myself growing excited. If I could learn how to utilize the Bagpipes' technique, I could make myself the richest man in HOS.

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The distant stars and the threads between them began to fade, to be replaced by a vague, shimmering image of a single Bagpipe. Deep within my head it began to speak, though not in words or phrases. There was no real syntax. It was a gestalt, a succession of pictures overlaid with something like intuition that let me detect, feel, but not necessarily fully comprehend, the whole of the idea the Bagpipe was trying to convey.

I now realized that the blob-like creatures in the rivers were my brain's visual depiction of crystalline intelligences whose physical presence was forever locked within the veins of crystal deposits like that which Xerxes was excavating—but whose minds were free to roam the uncharted domains of nullspace.

The Bagpipe flashed me glimpses of world after world, all of them far outside Human Occupied Space and each of them containing deposits of Carson's crystals. Each deposit comprised a living entity, or perhaps a tribe, or a group, or even a *nation* of these entities.

In our own three-dimensional world the crystals seemed dead and inert, mere hunks of rock, for we humans perceived only organic life. But the lattices that formed their structure had, over millions of years, evolved to form an intelligence that, though lacking physical senses in our Newtonian Universe, manifested themselves in the domain of nullspace.

For a fleeting instant, I wondered how many other supposedly inanimate objects might have attained some kind of life in the realms of nullspace. Had some of our supercomputers, which themselves were based on crystalline technology, also become sentient dwellers there?

By mining the deposits on New Sonora, the Bagpipe told me, Xavier Xerxes would not only destroy an entire collective of these creatures, he was also potentially injuring the entire Bagpipe species, for the Bagpipes depended upon the nullspace-expressed consciousness rooted in these crystals to guide/propel their ships from world to world. Without them, their ability to cross space would disappear.

I conjured up an image of the crystals in the *Venture*'s hold. "What about these?"

The response was instantaneous. It was imperative that my crystals be returned from where they had been mined. There, over an unspecified period of time, the crystalline structure would repair itself and grow again into a unified whole. But time was rapidly slipping away—the damage had to be repaired soon.

"Very well," I temporized. "But I'll have to figure out a way to actually do this. You don't understand human laws and customs. You'll have to give me time to figure out how to accomplish what you want."

"Why? Why? Why?" the Bagpipe seemed to wail. Then I got something like: "Short time. Soon." Was that a few days? Then, "No longer. We will take action." He projected an image of me trying to leave the planet and of their ship tracking me down, taking the crystals by force and destroying

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the *Venture*.

My vision blurred to a uniform gray and I found myself back in the *Venture* with my fingers fumbling to pull the Bagpipes' device from my head. Beside me Rebona Myking was tugging at her own band. She looked at me wide-eyed, her face filled with awe. "Did you see what *I* saw?"

"I suppose so." I glanced at the three aliens and heaved an irritated sigh. "At least now we know what they want and why."

"It's a nice ethical problem," I mused after the Bagpipes had left.

"I can see a number of them," snapped Rebona tartly. "Which particular one are you talking about?"

"My personal one. If I return the crystals I'll be left with an empty ship, no prospects, just enough emergency money to fuel up one more time and get off-planet, and absolutely nowhere to go."

"If you don't give them up the Bagpipes will chase you down and take them. What's the ethical problem?"

"Now we know what my crystals can be used for. It's obvious that I *am* sitting on Xavier Xerxes's fortune."

"So?"

"The Bagpipes need these nullspace creatures alive for their ships to work. But *we* don't. Tall And Thin's modifications to the *Venture* will let me see the currents in nullspace. It might take ten or twenty years and a few hundred million credits, but one way or another we'll figure out how to tie pieces of these crystals into our VR/navigation nets. The crystals' value is almost unimaginable. Every ship in HOS will need a chunk of the stuff. I can think of five corporations that would pay me millions in cash for what's in my cargo hold."

"OK, I can see how that would upset the Bagpipes, but why do you think it's an ethical dilemma?"

"Because as soon as the crystal's value is discovered they'll all be mined out and chopped up into little instrument panel-sized pieces. It will be like gold fever was centuries ago. In a generation or two humans will destroy the crystals and the Bagpipes' civilization with them."

"Then don't let anyone know about them."

"If I can't earn enough money in the very near future to keep up the payments on this ship, my artificial pancreas will shut down and I won't be alive to worry about *anything*. Being an ethicist doesn't mean I have to commit suicide."

"Can't you sell this one load but make sure that everyone knows that the crystals are part of a living creature? The New Sonorans aren't ethical morons. In fact, they're actually very dedicated environmentalists. They'd make the crystals a protected life form."

I heaved a deep sigh. "*That's* where the ethical nicety arises. In order to prove what we're saying, we'd have to show how the crystals can be used for nullspace navigation. Then, instead of just Xerxes and a few hundred thousand New Sonorans, we'd have 20 trillion other people all over Human Occupied Space trying to dig up Carson's crystals and install them in their ships. It would make things

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infinitely worse. It would certainly lead to war between humans and Bagpipes."

"War?" Rebona looked horrified. "You can't mean that!"

"I'm still a facilitator. Whether I'm licensed or not I can't escape seeing the consequences of a course of action. Everything I've ever learned tells me that war would be inevitable. If human use of the crystals became sufficiently widespread, it would not only doom the crystal creatures, it would eventually relegate the Bagpipes to a single planet. They're not stupid. Long before they let it come to that, they'd go to war to stop us."

"Isn't this the sort of problem facilitators are trained to solve? Can't you figure out a solution?"

"*If* there's a way out of this, I don't know what it is."

"What do you mean, *if?*"

"I mean that one of the first things a facilitator learns is that not all problems have a solution acceptable to all parties. It's entirely possible that this is one of them."

"I see." Rebona considered me for a long moment, then turned towards the hatch. "You'll probably get more accomplished without me around—I'll leave you to your facilitator-type thoughts." With what might have been a wistful glance over her shoulder, she made her way out of the ship.

The first of my facilitator-type thoughts was no more profound than: So *now* what?

No matter how I looked at it, Xavier Xerxes was obviously the key to the puzzle. One more attempt to reason with him could hardly make things worse.

Or so I thought.

An hour after Rebona left, the aircar the *Venture* ordered for me—through the local net settled next to the main ramp—and I climbed aboard. It was mid-afternoon when I reached the entrance to Xerxes's mine in the Hormagaunt Hills. His battered blue aircar had been joined on the rocky soil by an even more decrepit flyer that might once have been red. I strode through the adit to the shambles of the miner's living quarters. They were lighted but empty.

Sighing, I moved deeper into the labyrinth of dimly lighted tunnels that Xerxes had gouged out of the mountain. As I neared the rock face where his excavations had exposed the crystal lattice, I heard whoops and yells of drunken excitement. Had Xerxes brought in a gaggle of party girls, along with a basket or two of cactus petals, and gotten himself thoroughly bent?

Rounding the final bend, I saw a bright actinic light flickering against the wall in front of me. I turned the corner to the hemispherical chamber and was treated to a macabre display. The darkness was almost total, illuminated only by a single glow wand lying on the floor. It was enough, however, to reveal Xerxes and another man capering in front of the fifteen-foot-high wall of exposed crystal.

Xerxes's companion, well over six feet tall, with a beefy flushed face, an orange ruff of bristly hair, and the bloated body of a weightlifter gone to

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seed, was laughing maniacally as he twirled an eighty-pound beam welder around his head like a toy. Xavier Xerxes, giggling like a wirehead, was staggering back and forth as he tried ineffectually to wrest the welder from the other's grasp.

"My turn, MacKay," Xerxes whined, making yet another grab for the welder, "*my* turn!"

"Not yet!" MacKay howled gleefully. "Once more! I get to do it once more!" He lurched to his left, raised the welder, and pointed it at the center of the crystal face. I managed to shut my eyes an instant before he loosed a ten-foot beam of high-voltage electrons at the wall.

Built to draw huge currents from planetary mains, beam welders excite electrons to an extremely high voltage, then force them through a series of tightly focused magnetic fields to project a beam no more than three inches in diameter as much as fifteen feet from its muzzle.

When MacKay bombarded the crystal wall with high-voltage electrons the current had to find its way to ground. In doing so, it excited various portions of the lattice depending upon the electrical properties of the crystalline structure. MacKay was giving the crystal the equivalent of electric shock therapy.

Why he was doing it became immediately apparent. The moment the beam impacted the lattice, my mind was overwhelmed with fantastic images, colors, tastes, smells, and every other conceivable kind of perceptual sensation. It was as if someone had short-circuited every sensory nerve in my body, had fed me the electronic equivalent of a high-voltage psychotropic drug. These two lunatics were obviously enraptured by the experience, but even in the grip of sensory overload I knew that what they found so pleasurable was, in fact, the screams of terror and pain emanating from the crystal entity.

"Stop that!" I somehow managed to shout. "You're *killing* it!"

Stumbling forward, I attempted to wrestle the beam welder from MacKay's meaty grasp but I might as well have been trying to pull a musket from the hands of a bronze statue. At least now, though, the welder was shut off. As my mind gradually cleared, I continued to grapple ineffectually with Xerxes's enormous friend until he tired of the unequal contest and ponderously removed one massive hand from the welder.

"Look out!" yelled Rebona Myking from somewhere behind me. Startled, I simultaneously let go of the welder and stumbled on the uneven floor. MacKay's huge fist whistled past my ear as I fell. As I rolled desperately away from his flailing boots Rebona and two Bagpipes entered the room.

"What are *they* doing here?" I panted, gesturing at Tall And Thin and Trunk Like An Elephant, nonetheless very glad that they *had* arrived. For Xerxes and his crony MacKay had suddenly lost all interest in me.

"I'm sorry, but after I left your ship the Bagpipes found me again and demanded that I tell them what you were going to do. I tried to explain as well as I could but I think all I managed to do was confuse and upset

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them. They apparently decided to take some decisive action and they insisted that I come along to translate."

His tussle with me now forgotten, MacKay uttered an inhuman cackle and once again pointed the welder at the wall. The Bagpipes immediately began to hoot like a broken calliope. Ignoring them, MacKay fumbled for the trigger.

Trunk Like An Elephant scurried forward and wrapped two of his tentacles around the muzzle. Instead of contesting the Bagpipe for possession of the welder, however, MacKay let it swing free until its muzzle was pointed at the center of the alien's body. Then he pulled the trigger.

A blazing line of electricity splashed across and then through the Bagpipe. Trunk Like An Elephant uttered a single horrible discordant honk and fell to the floor, his central torso a smoking ruin. MacKay stared at the fallen Bagpipe's body, laughed, then raised the welder and swung it towards Tall And Thin. But the second Bagpipe was ready for him.

So quickly that the motion was barely visible, Tall And Thin produced a small egg-shaped device from one of his apron pockets. He waved it at MacKay in a pattern of three vertical strokes and six horizontal ones. At each stroke a thin, cleaving beam projected from the glittering egg and passed effortlessly through MacKay's body. In the space of a heartbeat MacKay fell apart like an onion diced by a chef's invisible knife. Three seconds after MacKay had turned the welder toward Tall And Thin he was nothing but bleeding chunks of meat, steaming and dripping on the cavern floor.

Now the Bagpipe turned the egg towards Xavier Xerxes. Still under the psychotropic affect of the crystal's wails, the terrified prospector burst into wracking sobs. Deep, ominous hoots rumbled from Tall And Thin's upper tubes as he raised the egg.

"Wait!" Rebona screamed. White-faced and sweating, she thumped her computer and initiated a furious volley of noise. Tall And Thin paused, then hooted back at her. "He says you've got to come with us," she eventually told the blubbering Xerxes. "He . . . he says that if you make any trouble at all he'll . . . he'll kill you just . . . just the way he did your friend." She turned away from the ghastly carnage.

Without waiting for a reply, Tall And Thin slid forward with his usual peculiar grace, grabbed Xerxes's wrists with two of his tubes, and yanked the miner towards the tunnel. As he slithered past Rebona, a third appendage snaked out to grab her right arm. Startled, she uttered a muffled gasp. Tall And Thin's only response was to wrap another tube around her waist and drag her even closer.

Without conscious thought I started towards the Bagpipe. In a blur of motion one of his lower appendages seized a rock from the floor of the cavern and launched it with terrible accuracy at the top of my head. The struggling form of Rebona Myking was the last thing I saw as I lost consciousness.

* * *

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Like everything else in Saguaro, police headquarters was inside a giant cactus. The officers seemed marginally less listless than most of the other natives I had so far encountered. Perhaps they weren't allowed to chew on duty.

"So you're the facilitator," the chief of police said without any sign of friendliness. A sign on his desk identified him as Colonel Gerald Mouers. Tall, leathery, and completely bald, with a long, beaklike nose, he made me think of an ancient Galápagos sea turtle.

"Ex-facilitator, but how did you know that?"

"Xerxes managed to get out a brief call on his wristphone before it went dead. According to him he's been kidnapped by the Bagpipes. He said you were involved."

"In the sense that I tried to save him and got knocked unconscious for my trouble," I growled as I rubbed the egg-sized lump on the top of my head. Flakes of dried blood drifted down to the Chief's immaculate desk.

"Tell me about it," the Colonel ordered, waving me to a seat and, after a moment's hesitation, passing across a bottle of painkillers from a desk drawer.

I told him, leaving out any mention of what I had learned about the crystals from the Bagpipes.

"So Dolf MacKay's got himself chopped up into little bits, has he?" mused Mouers when I had finished. He didn't seem particularly upset by the news. "He's another offworlder, from Propertyville, I think."

"I suppose," I said impatiently. "But even if you can't blame the Bagpipe for killing MacKay in self-defense, I don't know what they might be doing to Xerxes right now, and, more importantly, to Rebona Myking. What are *you* going to do?"

"A posse of sworn deputies is being assembled up on the roof right now. You figure they've taken them back to their cactus?"

"They don't respond like humans. I don't think it would occur to them to try to hide."

"Then we'll go over there and get the two of them back."

"You'd better be careful. We don't have any idea what kind of technology they've got."

Colonel Mouers considered my words. "You're a facilitator, a disbarred one at that, not a law enforcement officer. So leave the law enforcing to us—we know our job." He tugged at his bony nose. "On second thought, I think I'll ask you to come along. You said you'd been inside their cactus—you might be useful."

I nodded with no great enthusiasm. The colonel was obviously of the "Pull out your gun and kick in the door," school of policemen. It was highly probable that he was going to charge in without further thought and get himself and his so-called posse summarily slaughtered. *That* didn't bother me—but it was probably going to be up to me to think of something to keep Rebona Myking from being chopped to bits along with the others.

It was late afternoon when our convoy of twelve civilian aircars and two official ones containing perhaps thir-

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ty-five people approached the Bagpipes's Demon Lover cactus. Slightly below the lead vehicle in which I rode I could see the cactus's bright yellow and orange flowers in full bloom. Not entirely the fool I thought him to be, the cautious Colonel Mouers followed at a discreet distance.

I turned to the grim-faced female police officer sitting at the controls. "What do you—" That was when, in the middle of a clear and entirely unobstructed sky, we ran into something.

As the lead aircar, we had already slowed to little more than twenty miles an hour but the impact still felt like we had run into a huge, slightly flexible plastic wall. An instant later I was in total darkness as the craft's airbags deployed around us. And moments after that I felt my head and stomach changing places in nauseating fashion.

We were falling, tumbling as we went.

From 500 feet . . .

An eternity later, still enveloped by the airbags, we smashed into the desert.

When we were pulled from the wreckage my heart was pounding furiously—but my only injury was a slight tenderness in my ribs where an airbag had thrust my arm painfully against my side.

"What happened?" I muttered to Colonel Mouers, who stood scowling down at me.

"It looks like you ran into a forcefield."

"Forcefields are impossible."

"I guess no one told that to the Bagpipes."

I shook my head groggily. "How many of the others ran into it?"

"Just one. You were a little bit ahead, so we had some warning."

"Now I see why you brought me along." I looked at him grimly. "What about Rebona?"

Mouers jerked a thumb in the direction of the giant cactus. "She's still in there, I suppose."

"You don't know?"

"How can I? My men have been walking around, and flying around, this damned thing for fifteen minutes but we haven't found a way in. It goes all the way around and up over the top."

The chief was only partially right, I discovered a few minutes later. My own left hand went easily through the forcefield with only a slight tingling until the edge of the field encountered my wristphone. Then my hand stopped abruptly. I removed the phone and tried again. This time my arm penetrated to the edge of my shirt sleeve. As the Colonel looked on skeptically, I removed my shirt. This time my arm went in as far as my shoulder. I didn't feel like sticking my head in.

"Organic matter seems to pass through," I pointed out, "while anything artificial seems to be stopped. If anyone in HOS still wore pure cotton or pure wool instead of these synthetics I'll bet they'd go through too. As it is, it looks like all we have to do is take off all of our clothes."

"And go in after them stark naked? With no weapons and them fully

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armed? What would we do once we found Xerxes and Myking, throw *rocks?*"

"Are you just going to sit out here and do nothing?"

Colonel Mouers gave me as hard a look as I was giving him. "I always knew Xerxes was going to get into trouble fooling around with those crystals. He's gotten himself into this mess and I don't intend to make things worse by taking my people in without a plan that has a chance of succeeding. Those aliens are armed, you said."

"What about Rebona Myking?" I repeated between clenched teeth.

"What we've got here is a classic hostage situation. The book says that when you have a barricaded suspect you sit back, let him get tired, and then you negotiate a solution. You don't go running in without a plan. That will only get people killed. The Bagpipes aren't going anywhere and neither are we. We can wait longer than they can. I suggest that you go back to your ship and leave the law enforcement to the professionals. If we need you we'll call you." Mouers clenched his jaw and pointed me toward one of the civilian aircars. "Cal, take this guy back to town, will you." It wasn't a question.

As we flew away, I watched the police settle in to their positions around the cactus. They seemed to be getting comfortable for a long stay.

Half an hour later, as I was sitting in the same chair in the ship's salon that Rebona Myking had graced so recently, my wristphone rang. To my astonishment it was Rebona.

"Are you all *right?*" I half-shouted.

"More or less. Having been married to an ethnologist, this isn't the first time I've been in . . . peculiar circumstances." She uttered a faint sound that might have been an attempt to laugh. "In spite of everything, the Bagpipes still need me to translate for them. I'm sure that's their only interest in me. I'll be fine."

"What are they doing?"

"I think they want to trade Xerxes and me to you for the crystals in your ship, but first they say that Xerxes must resonate with the crystals so that he can empathize with them."

I ran that through my mind two or three times.

"What does *that* mean?"

"I don't know, but I don't think it means anything good for Xerxes. The last time I saw him, he was being strapped into a tangle of their equipment and they were attaching pieces of crystal to his head."

I uttered an exasperated sigh. "I'll worry about him later. Where are you right now?"

"Just outside the room in the center of the cactus where you first talked with them. Once I finished translating for Xerxes they lost interest in me. They don't think like we do at all."

I thrust myself to my feet. "Don't move," I ordered. "I'll come and get you."

Standing in the ship's hatch on the edge of the boarding ramp, I stared up at the unfamiliar constellations that filled the night sky. Easy to say

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that I'd come and get her. But how?

I was, I knew only too well, a facilitator, not a warrior. But unfortunately, I now had little choice. I didn't much care what happened to Xavier Xerxes, any more than I did about Dolf MacKay. And while I most certainly did care about Rebona Myking, even that was peripheral to my main concern.

A facilitator's gift is a curse as well as a blessing. Sometimes it forced me to read the future as clearly as if it were scrolling down my monitor, circumscribing my freedom of action as surely as if the doctrine of Predestination really was driving the Universe.

And I now saw the future very clearly.

The Bagpipes didn't, apparently, understand the concept of the transfer of property, or perhaps even of "property" at all, at least not in the human sense. Unless this mess got cleaned up right now, it was inevitable that someone was eventually going to ask one too many questions about the Bagpipe's interest in the crystals or, after he was killed, would buy Xerxes's mine from his estate and sooner or later discover what the crystals could do.

Then we would end up at war with the Bagpipes as surely as I was standing here. Given what I had seen of their technology, it was a war that the mysterious and disquietingly confident aliens might well win. Gritting my teeth, I marched back into the ship. It was time to find out as much as I could about the Demon Lover's narco-flowers. . . .

* * *

The most salient thing I had learned from my crash course in New Sonoran flora and fauna was that the giant butterflies of New Sonora wouldn't fly at night. So I had had to wait impatiently for first light. Now, as I cruised through the dawn sky with Icarus just above the Dragontooth Mountains, the air rushing across my bare skin was still somewhere between chilly and cold. And in light of the Bagpipes' forcefield I was, of course, not only unarmed, but also totally naked.

My only accessories were a small set of leather saddlebags draped across my thighs. The saddle on which I sat was composed entirely of leather. Any non-organic straps and metal fittings had been removed, including my safety harness. If I was wrong in my reasoning, the Bagpipes' field would knock me off the 'fly and I would find myself tumbling several hundred feet to the desert floor, this time without airbags. I gripped the saddle even tighter with my knees.

Just ahead and to my left I spotted the Bagpipes's cactus, its blunt tip bursting with its crop of enormous flowers. Gently I jiggled the butterfly's control-bone. My mount made a lazy turn and angled obediently towards my destination.

As we neared the cactus the 'fly began to zero in on the flowers. I held on tight and waited for us to hit the field. When the moment came it was totally anticlimactic. If the butterfly even noticed the Bagpipes' barrier it gave no indication. I myself felt nothing but a momentary tingling across my skin.

My mount settled into the gentle

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concavity of one of the flowers, extruded its feeding tube, and began to probe for nectar. With one hand around the saddle's leather handle I leaned out as far as I dared and began tearing fragments from the yellow petals. In a few frantic seconds I had my saddlebags filled with pieces of the pulpy blossoms. Finally, by dint of several kicks and a few sharp jabs on the butterfly's control-bone, I managed to tear my mount away from the flower and into a descending spiral around the cactus.

A quarter of the way down the far side we drifted toward the shadowy mouth of the chamber we had entered the day before. The butterfly's wingspan was far too great to fit through the opening but through creative gardening and the use of growth hormones the plant's skin had been persuaded to bulge out into a small landing terrace. My 'fly fluttered to a gentle halt on the edge of the pad. I slipped from the saddle and, after wrapping the creature's leather halter around a cluster of spines, threw the saddlebags over my shoulder and hurried into the tunnel.

It was even darker than I remembered but I managed to reach the shaft in which we had earlier taken the transport disks. I considered it dubiously for a long moment, then slipped past and padded into the darkness. For several minutes I moved cautiously through the inky tunnels, navigating nearly as much by the slight echoes produced by the slapping of the soles of my feet against the succulent's resilient floor as by the occasional patches of dim light that appeared at erratic intervals.

Just as I was beginning to wonder if I was hopelessly lost, I heard the soft hooting echoes of Bagpipe conversation intermixed with an eerie, undulating wail. Dragging my left hand along the corridor's wall to keep from smashing into unseen obstructions, I stepped up my pace.

The tunnel came to an abrupt end at a dimly lighted chamber near the heart of the cactus. The silhouette of Rebona Myking appeared just before me. Beyond her were two Bagpipes and, slumped within a tangle of alien equipment, the corpselike form of Xavier Xerxes.

I paused in the tunnel's darkness only inches behind Rebona. I could see Tall And Thin and Almost Gray standing over Xerxes, a dozen of their appendages beating a staccato tattoo on the weakly glowing surface of an instrument panel. Suddenly Xerxes's body tautened, his eyes popped open, and he emitted a high, bloodcurdling shriek to which the Bagpipes remained utterly indifferent. Heart pounding, I slid forward and clapped my hand over Rebona's mouth.

"Not a sound," I hissed into her ear as she struggled frantically. "We've got to get you and Xerxes out of here." Her body relaxed and she let me pull her back into the blackness of the tunnel.

"What are they doing to him?" I whispered when I thought we had retreated far enough to avoid being overheard.

She shook her head back and forth wildly. If she noticed I was naked she gave no sign. "I don't know. I don't

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think they're *trying* to hurt him, but they have no way of understanding us." Taking a deep breath, she made an obvious effort to compose herself. "I think they're just trying to change his mind, to convince him to leave the crystals alone, but God knows what it's like from Xerxes's side of the conversation. Did you see how his body stiffened up? I'm afraid they're going to kill him."

I nodded grimly and pulled her another couple of steps away from the Bagpipes' re-education chamber.

"Do you think you could talk them into letting Xerxes go?"

"No—I've already spent hours trying. I think they've decided that we humans are either crazy or just plain evil."

I looked at her bleakly. "Then we've got no choice. I'm going to have to get you and Xerxes out of here before I deal with them. Here," I said, reaching into my saddlebags and shoving some torn-up narco-flower blossoms into her hand.

"What's this for?"

"We know these things have a powerful effect on humans. I've taken a look at their chemical structure. They should affect almost any creature with a nervous system even remotely similar to those I'm familiar with. Besides, I remember you telling me that the Bagpipes were affected by them too. We're going to mash this stuff down every tube we can reach. I'm hoping it will make them sick or dazed or dizzy or at least distract them enough so that we can get Xerxes out of here."

"I only said I *thought* they might be affected by it! No one really knows if the blossoms have any affect on them or not."

"When your choices are slim and none, slim is better."

Shaking her head and plainly scared, Rebona accepted the handful of petal fragments, then followed me back towards the aliens' chamber.

This time Tall And Thin and Almost Gray detected us as soon as we entered the room. Their lack of familiarity with human beings apparently kept them from interpreting our abrupt intrusion as a personal threat. Possibly they considered themselves physically invulnerable to unarmed humans. And who could be more unarmed than the totally naked Isaiah Howe?

At this point subtlety was useless. I simply walked up to Tall And Thin and began stuffing handfuls of flower-petal pulp into every open orifice I could find. Beside me Rebona was doing the same to Almost Gray. The Bagpipes immediately backed away, then stood very still, perhaps trying to comprehend what was happening. Seconds later they began to shake, snort, spin, flail their tentacles, and expel atomized clouds of petal pulp.

I didn't wait to find out what happened next. Discarding the saddlebags, I pulled Xavier Xerxes's limp body from the tangle of instruments, brushed the crystals away from his head, and threw him over my shoulder. Then I staggered out of the chamber with the best speed possible.

Rebona trotted ahead of me and, by the feeble glow of her computer's dis-

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play screen, we worked our way up through the tunnels. "Almost there," I panted, "that light we see must be—"

We rounded the last bend.

The silhouettes of five Bagpipes blocked the entrance to the landing platform, their tentacles waving ominously. Rebona and I skidded to an ignominious halt.

"These aren't the best circumstances under which to begin negotiations," I growled as I tried to keep Xavier Xerxes's leaden form from slipping to the floor, "but I don't think we have much choice. Tell them I've figured out a way to protect the crystals from any further interference."

"I'll try. I have the words for 'agreement,' 'acceptance,' and 'success.' We'll see if that works." Casting an anguished glance at the aliens, Rebona lowered her eyes to her keypad and moments later the tunnel was filled with the grunting, hissing hoots of the machine's pidgin language. I let Xerxes's slack body sag to the floor, where he lay snoring raggedly.

"Tell them my solution won't work if they continue to torture Xerxes, that they'll only cause the human authorities to get further involved, and that if that happens everyone in Human Occupied Space will find out about the crystals' real value."

"'Danger' and 'caution' are about the best I can do. I'll see if my dictionary has anything else that might work."

For a full minute after Rebona completed her translation the five aliens huddled in a group, looking like a thicket of bamboo trees thrashing about in a hurricane. Finally one of them burped a reply.

"He . . . says something about danger, distrust, uncertainty, concern, change, or perhaps death as solving the problem. It doesn't look like they're in a frame of mind to negotiate anything."

"Tell them that if Xerxes is killed, or mind-damaged, it will be impossible to protect the crystals. That if they come to my ship we'll use the translator they installed and I'll be able to explain my solution to them."

"I'll tell them 'negotiation,' 'meeting,' 'success.'" Rebona continued her manipulation of the translator. Eventually the Bagpipe spokesman made his reply.

"Now they're saying lack of trust, fear. I think they want one Bagpipe to go with you and one of us to remain here."

"Do we dare leave Xerxes? Do you think they'll go back to work on him?"

"I . . . don't know, but I've been working with them for months now. I don't think they'll hurt me. Take Xerxes and I'll stay here as their hostage."

I nodded grimly. The logic was unassailable but it was a decision she alone could make.

"I'm afraid that's the only alternative," I agreed, then manhandled Xavier Xerxes to his feet. "Tell them it's a deal."

"Isaiah," Rebona called after me, "you really *do* have a plan, don't you?"

"A terrific one. Don't worry about a thing."

Now all I had to do was convince the Bagpipes of that. One of the aliens manipulated a preprogrammed net panel to call for an aircar, then

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dropped the forcefield when the flier approached. During the brief trip to the *Venture* he kept a duplicate of the glassy egg-shaped weapon that had killed Dolf MacKay pointed at me. If the police noticed the flier leaving, they didn't bother to give chase. I suspected that the officers on early morning watch were busy chewing a few petals of their own.

Once inside my ship I laid Xerxes on the bunk, checked his pulse and breathing, and found them apparently normal. At least I didn't have a corpse on my hands. Yet.

Turning back to the Bagpipe that I had named Black-Ringed Tubes, I saw that his weapon was still firmly centered on my chest. Ignoring it as much as possible, I led him to the control console where the two crystal bands were still wired in place. In a show of bravado, I snatched the nearest one and yanked it over my head. Seconds later I was back in virtual space. This time, however, along with the millions of stars, wavering before me was a stylized representation of Black-Ringed Tubes.

"Humans have an institution called trade or barter or bargaining," I began, "all of which are subsets of negotiation." I conjured up mental pictures of one person pushing a basket of fruit across an open space and of another person pushing a domestic animal back. Then I moved on to the more difficult concept of money. After a long pause Black-Ringed Tubes conveyed the impression that although his knowledge of human culture was sparse at best, he had managed to grasp these basic concepts of commerce.

"Xerxes doesn't care about the crystals for themselves," I tried to tell him, "he only sees them as a way to obtain money. If there were another way to obtain money, Xerxes would leave the crystals alone."

"You will give him this concept you call money?"

"No, *you* will trade something to Xerxes that will be more valuable to him than the crystals. He will then get money from what you give him and, in exchange, he will leave the crystals alone."

"I/we have no money. Trick?"

I wasn't sure if the Bagpipe was asking if I was tricking him or if I was proposing that a deceit be practiced on Xerxes.

"No, but you have something that is *worth* money, the device that makes your shield, the forcefield you set up around the plant where you are now living. That device is unknown in human culture. The ability to manufacture and sell such a machine would be more valuable to Xerxes than the crystals. If you can show me how to manufacture it, then in exchange I can get him to give up the crystals. Can you do that?"

"A simple device. Easily constructed, well known."

Did I detect a note of surprise that we humans didn't understand something as simple as their forcefield generator? I also got the disquieting impression that to them it really *was* no more than a minor trinket. Just how advanced *were* these people?

No matter. For the moment, my concerns were purely short-term. I returned to the negotiations and even-

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tually we seemed to reach an understanding.

The Bagpipes would turn over to me all of the technical information needed to build a forcefield generator. I would sell this technology as Xerxes's agent. A portion of the proceeds would be used to obtain clear title to all deposits of Carson's crystal on New Sonora. The deeds would be placed in an irrevocable trust with a local bank as trustee. The bank's fee for the next one hundred years would be paid in advance. Sometime during that period the Bagpipes would return to New Sonora to advance another century of fees.

The moment the trust was established, I would give the Bagpipes my own cargo of crystals. In return, I would take from the remaining balance of the forcefield sale enough money to refuel and reprovision my ship. From what remained I would then take a fifteen percent finder's fee. Xavier Xerxes would keep the rest. Even as I struggled to convey these mystifying concepts to the Bagpipe, another part of my mind was calculating that the miner's income from the licensing fees would probably exceed 150,000 credits a year. And that fifteen percent of *that* would also be mine.

I took a deep breath and tried to focus on Black-Ringed Tubes's wavering form. "And finally," I said, "a few small points. . . ."

I *liked* the concept of being the only human being in all of Human Occupied Space who could read the currents of nullspace. For a star-freighter captain it would be an asset of incalculable value. And, of course, *someone* had to be the duly appointed intermediary between the Bagpipes and Human Occupied Space.

Could anyone be more qualified to fill that role than Isaiah Howe?

An eternity later, Black-Ringed Tubes reluctantly conceded that the loss of a small piece of crystal two or three inches across wouldn't cause irreparable harm to the creature in the Hormagaunt Hills. Once the blocks in my cargo hold had been put back the missing fragment would eventually regenerate itself. The Bagpipes would permanently install my piece of crystal inside the *Venture*'s control panel, where it would be connected to the two translation bands. I would then become the only human being in the Universe able to freely navigate the currents of nullspace.

In return for this, I generously agreed to meet with the Bagpipes at least once every six standard months and to act as their representative in dealing with any problems that might arise between them and the human race.

Wearily I pulled the translator band from my head. All in all it seemed a fair settlement—not, of course, that a formerly licensed Senior Facilitator such as myself would have been satisfied with anything less. The only remaining question was whether Xavier Xerxes would have enough sense to accept it as an alternative to the aliens carting him away and rearranging his brains for good.

Of course, matters would also have to be smoothed over with the colonel, but if neither Xerxes, Re-

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bona, nor myself were willing to testify, then there was no proof of any kidnapping. We would all swear that MacKay's death was self-defense so there wouldn't be much the colonel could do as long as we all stuck together, as I was sure we would. There is no better glue than money.

As I turned my eyes to Black-Ringed Tubes's multi-appendaged body, I suddenly realized there *was* another question: Which of his dozens of tubes and tentacles was I going to shake to close the deal?

"Just when I was getting used to you without clothes," said Rebona Myking lightly, "you had to go and put them back on again."

"That can be easily remedied," I grinned.

"Mmmm." She shifted gracefully in the lead saddle of the butterfly we had rented early that afternoon. Beneath us, the 'fly torpidly drank from an enormous blossom. Rebona tossed her auburn hair over her shoulder and uttered an exhausted sigh. Though her face was haggard and her eyes weary, she still seemed lovely.

"Is it really over?" she murmured. "You've arranged everything with the Bagpipes?"

"Yes. Maybe five or six years from now we'll discover that I completely misunderstood what they were saying and then we'll have an intergalactic war after all, but for the moment I really think it's over."

"And Xavier Xerxes?"

"He's going to be a rich man. The Dorado Conglomerate on Voreth III has been grappling with forcefield technology for decades now and getting absolutely nowhere. Even from here on New Sonora I ought to be able to conclude a deal by nullspace courier drone in a couple of weeks."

"You know how the field works?"

"I will soon enough."

Rebona Myking turned her profile to the orange and green sunset forming above the jagged line of the Firefly Mountains. "So your pancreas is safe for another year."

"Once I have the money to make my payment."

"Then you'll be leaving soon."

"It'll take a while to get the trust established and to complete the transfers of title and sign the license agreement. I can't leave until the off-planet funds are confirmed and my fee paid so that I can buy fuel and provisions. You know how slowly things work on New Sonora."

"Yes." She turned away even further so that now all I saw was the back of her head. Was she thinking of the petalhead husband whom she hadn't seen in nine months?

"So you'll be here for at least a couple of weeks then," she said in a small voice.

"Yes. In the meantime, that's an awfully pretty sunset getting started over there. How about getting this butterfly away from this blossom and flying on over for a closer look? Then maybe we could go back to the ship and open a bottle of real wine. I've got one I've been saving for a special occasion." I reached out and tentatively took her hand.

Rebona squeezed my fingers firmly.

"I thought you'd *never* ask." ■

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Chris Vuille, Ph.D.

RELICS OF THE BIG BANG

What's out there hiding in deep space beyond the reach of our telescopes? Are there any exotic particles or cosmic structures that may be of use to future societies?

Astrophysicists think there are, and it's possible some of them are being detected today. Leftovers, you might say, of the biggest free lunch there ever was.

Relics of the Big Bang.

According to current theory, the Universe began in an enormous explosion sometime between ten and twenty billion years ago. The density of matter at that time was absolutely stupendous: take the planet Jupiter and compress it into a soda bottle, and you'll have a ballpark estimate. Temperatures, similarly, were way off the scale. The Universe was so dense and hot that normal matter as we know it couldn't possibly have existed.

That's the point, of course. Only abnormal matter could thrive in such an unimaginable inferno.

Not long ago, particle physicists began to wake up to the fact that their theories of matter could no longer be tested by existing hardware. And prospects for getting proper equipment were slim, especially since to test, say, a theory of quantum gravity, a cyclotron the size of the Galaxy would be needed.

Obviously, no amount of deficit spending could possibly rectify such a situation. So particle physicists were thrown into an intolerable state of affairs where their theories might just as well be drawn from the pages of a science fiction magazine. Their brilliant ideas simply couldn't be tested.

Soon, though, it began to dawn on them that the Big Bang was better than any atom smasher they could ever devise. And, best of all, it was free.

So they started hanging around with cosmologists, an eclectic and eccentric group that had never enjoyed much respect before the discovery of the cosmic microwave background.

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And the marriage of these two groups of scientists—of those who study the very small with those who study the very large—has been a highly fruitful one ever since. The particle physicists are happy, because with the Universe as their laboratory, they have a means of testing their theories. The cosmologists are happy, because finally other scientists are taking them seriously.

And, of course, the astronomers are also happy: they have a few new things to look for, namely the relics of the Big Bang.

PBHs, Nuggets, and Other Cosmic Leftovers

There are three main categories of relics that may have resulted from the Big Bang. The first type consists of particles of various kinds and their conglomerations. These relics range from the extremely prosaic, such as the famous microwave background radiation, to such interesting oddities as primordial black holes and quark nuggets.

Primordial black holes are miniature versions of stellar-sized black holes. Without a Big Bang you wouldn't expect to find any at all, since ordinarily it takes the collapse of a star to create a black hole, and stars have a lot of mass. The smallest stellar black hole would be expected to have a radius of around three kilometers. In the early Universe, however, the tremendous pressures might have made it possible for microscopic black holes to nucleate out of the expanding matter. Primordial black holes, or microholes, would be very useful as trash compactors, and possibly as power sources, using the ingenious process imagined by Roger Penrose, or simply by using the radiation they emit as they evaporate.

The evaporation of black holes was one of the great discoveries of Stephen Hawking. Hawking calculated that particles and their anti-particle counterparts would be produced in the highly stressed spacetime near the event horizon of a black hole, and that odds were good that one of the particles would be captured, leaving the other free to go off to infinity. The net result is radiation from the black hole, and a gradual reduction of its mass.

This black hole radiation could be put to good use by advanced societies. Large black holes radiate very slowly, but the small ones would have a brisk output. The main problem would be containment. This could conceivably be accomplished by charging the holes up, which would make it possible to haul them around with electromagnetic fields. Otherwise, they'd have an unfortunate tendency to fall through whatever container they were in. Physicists could then spend their remaining time on Earth calculating whether the microhole would devour the planet, or go into burst mode and blow it up.

The explosive potential of microholes comes from the fact that the rate of evaporation is inversely proportional to the second power of the mass. That means the smaller the hole, the faster it evaporates, shooting off energy in the form of high-energy photons like ultraviolet light and X rays. There might not be many of them around anymore: a microhole

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would have to have at least the mass of a mountain in order to survive into our present era before evaporating in a final hot flash. What's interesting is that in the last few years a large number of such hot flashes have been observed by space-based ultraviolet observatories. These hot flashes, called "bursters," have the scientific community excited and baffled. The bursters may represent the first evidence that micro black holes were indeed produced in the Big Bang, though some feel that the ultraviolet background is too weak for that to be the case.

Quark nuggets, like microholes, may also have been produced under the conditions of extreme temperature and pressure. Quarks are believed to be the constituents of ordinary matter. For example, a proton is composed of two up quarks and one down quark, whereas a neutron has two down quarks and an up quark. Ordinarily, quarks are bound together in twos and threes, and never occur by themselves. In the early Universe, however, there would have been enormous numbers of them flying around free. Many of these would have annihilated with their antiparticles, or eventually frozen out as protons and other particles. Others, however, may have stuck together in lumps in relatively large conglomerations—nuggets—something theoretically impossible under normal conditions. These nuggets would be denser than the neutronium in neutron stars. Protons and mesons would likely bubble off them at a fairly high rate, so quark nuggets would constitute a radiation hazard. The basic unit would probably be a combination of an up, down, and strange quark, which is fairly stable but not seen in normal matter. Appropriately, it's called strange matter, and may be found in the cores of neutron stars.

Primordial black holes and quark nuggets aren't the only exotica in the theoretical relic zoo. Some of these exotica may be part of the dark matter that constitutes 90% of the Universe. A favorite pastime among astroparticle theorists is inventing new particles and then trying to find them, so there's no shortage of dark matter candidates. Axions, photinos (which are, interestingly, their own antiparticles), gravitons and gravitinos, miscellaneous low-grade photons, heavy neutrinos, various WIMPS (weakly interacting massive particles) and the like all ought to have been produced in great numbers, according to one or another astroparticle physicist. Heavy neutrinos would be an especially lucky find, because some think they might be hiding inside the Sun, cooling down the core and accounting for the fact that the observed flux of neutrinos from the Sun (produced in nuclear reactions) is far lower than it is expected to be. Axions would also cool the solar core, and in addition solve some serious technical problems in quantum chromodynamics, the theory of the color force between quarks.

If any such exotic particles exist, they would take the form of a low-level background flux, like the cosmic microwave background. And if we don't find them, of course, then a lot

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of physicists are going to be taking their half-baked theories back to the theoretical kitchen.

Central to virtually all these theories is the electroweak theory of Weinberg, Salam, and Glashow. This theory unites the weak nuclear force, which is involved in various decay processes, and the electromagnetic force. Extensions of this theory include GUTs, or Grand Unified Theories, which unite the strong and weak nuclear forces with electromagnetic forces. In a sense, then, the existence of various exotic particles or structures is a test for this successful and widely acclaimed theory.

So far, though, the pickings are fairly slim, so slim that a totally new theory, called "inflation," had to be invented to explain the paucity of relics. Inflation refers to a hypothetical period of turbo-charged universal inflation during the very beginning of the Universe. This period of hyperexpansion—much faster than the normal expansion of the Universe—would dilute the exotic species down to the point where it would be hard to find them. Even the giant defects in spacetime might be rendered rare and unobservable.

Which brings us to the next category of relics.

Defects in Spacetime

Defects in the structure of spacetime constitute the second category of Big Bang relics. These result from something called spontaneous symmetry breaking, and come in several sizes and shapes.

First of all, what is spontaneous symmetry breaking? A good example of symmetry breaking is what happens when water turns to ice. As liquid water, the molecules can swirl around any way they wish. You can think of the water as having a "rotational symmetry," since any way you look at it, it looks the same.

When the water freezes to ice, however, you suddenly have a crystal with a regular structure. The lattice of crystal looks different when viewed from various directions. The former symmetry, as liquid water, is broken. Furthermore, ice crystals may start forming in different regions, with different orientations. When these regions grow together, defects will be observed between them: points, lines, and planes, which can be seen in ice cubes right out of your refrigerator.

Now, as the Universe expanded, it cooled, just as the Freon in a refrigerator cools as it expands. And just as cooling water can turn to ice with defects, many scientists believe that interesting relic defects would have "frozen out" during the initial phase of expansion. The relic defects predicted include: a point-like defect, called a magnetic monopole; a string-like defect called a cosmic string; a sheet-like defect, called a domain wall; and an extended defect, called a texture.

Magnetic monopoles were first postulated by Paul Dirac in the thirties, and physicists have been looking for them unsuccessfully ever since. Imagine taking a magnet and cutting it in half. Ordinarily, you get two magnets, each of them having a north and

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south pole. This is because magnetism is caused by a circulation of electrons at the atomic level.

A monopole, on the other hand, would be either a north or south pole in isolation.

This is a rather radical idea, and goes contrary to our everyday experience. And such monopoles, if they exist, would be quite remarkable.

First of all, though they'd be submicroscopic in size—far smaller than a proton—they'd be enormously heavy: a hundred thousand of them would mass about a microgram! That doesn't sound like much, but comparing the mass of a hydrogen atom to the mass of a monopole is like comparing the mass of a child's paper boat to that of a battleship. For something so tiny, monopoles would be absurdly massive.

A useful feature of monopoles would be their ability to annihilate all other forms of matter. They would eat everything in their path, but rather than keeping most of it down for a later grand burp like a microhole, they would convert the matter immediately into energy by stimulating proton decay. A car constructed around a closed-cycle monopole steam engine could cruise for decades on one tank of water, with no pollution at all. Of course, they could also be used in highly efficient space drives, surpassing even antimatter propulsion.

Unfortunately, only a single experiment has ever detected a candidate monopole, and subsequent efforts have failed. This is bad news for particle theorists, since there ought to be lots and lots of them, everywhere. Rapid universal expansion—particularly the turbocharged inflation model—may account for their scarcity, however, so all is not lost.

A second type of monopole, the global monopole, also known as a hedgehog, would be so enormous that it's unlikely astronomers could possibly overlook it, no matter where it was in the Universe. The mass energy of the hedgehog is thought to increase linearly with distance from the core. Hedgehogs and anti-hedgehogs would attract each other strongly, moving towards mutual annihilation at relativistic speeds. Because of this, not many are expected to be hanging around today. Some scientists think they may have created perturbations in the homogeneity of the Universe, leading to large-scale structure formation.

Cosmic strings, not to be confused with the strings of string theory, are again predicted as forming during the inflationary period just after the Big Bang. Whereas ordinary magnetic monopoles are submicroscopic, cosmic strings, like hedgehogs, would be enormous, far larger than galaxies, long, twisting tubes of "stress-energy" stretching for thousands, even millions of light-years. Right after the Bang there might have been great networks of them, all tangled together like a ball of yarn the cat got into. Wherever they intersected themselves they'd tend to join and form loops, which would then spin like gigantic hula hoops, rapidly radiating away their substance in the form of gravity waves.

One interesting property of cosmic strings is that the spacetime around

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them would be very nearly—but not quite—flat. This is paradoxical for such massive objects, but follows from solutions of Einstein's field equations. The only difference from flat space would be a curious deficit angle: the distance around a circle would be less than 2π times the radius! A cosmic string, passing through an observer, would cause the opposite sides of that observer to approach each other at about a kilometer per second, not a healthy prospect.

Cosmic strings and loops are thought to have formed the seeds of galaxies. Just how and why galaxies formed is one of the big unsolved mysteries in astrophysics. The problem is, despite all its violence, the Big Bang was apparently a very smooth and uniform event, a kind of perfect explosion that was the same in every direction. The evidence for this is very strong in the microwave background, which has a uniform temperature across the sky, though recently faint ripples have been detected in this distribution. Without any lumps, wrinkles, or other imperfections in the expanding gas of the Universe there wouldn't have been any reason for galactic-sized clumps to form, and the Universe would have turned out to be a very boring place: just an expanding cloud of gas—no galaxies, no stars, no planets, no sentient beings to ever get interested in the origins of things. The cause of the recently detected ripples in the microwave background has yet to be explained, though perhaps cosmic strings or other defects are involved.

Still, there's the same problem with cosmic strings as with magnetic monopoles: they haven't been observed. But astronomers are still looking for them, and they may yet turn up if we look deep enough into space.

Like cosmic strings, two-dimensional defects, called domain walls, are supposed to be fantastic, galaxy-spanning structures. They are thought to take either the form of sheets or of gigantic bubbles. The bubbles expand, contract, or oscillate in and out, while the sheets often move at relativistic speeds. The exact behavior depends on the nature of the spacetime on either side of the wall.

Domain walls have a very intriguing property: if you're close to one, they push you away.

That's right. They repel you, drive you further away. Domain walls exhibit repulsive gravity.

If you could rig a small one to the back of a spaceship, you could use it to travel anywhere you wanted, like an antigravity space drive. The tension of the wall, according to Einstein's equations, is what creates the repulsive effect. It acts like a source of negative mass, a hypothetical substance with remarkable properties.

There are two problems with such a space drive, however. First, domain walls are under such incredible tension that any normal matter would be torn to pieces long before the repulsive gravity effect could be obtained. Ordinary everyday tensions, such as that created by stretching a rubber band, are too weak by about twenty powers of ten! Furthermore, the repulsive gravity effect is actually limited in

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range: at a distance, the wall becomes attractive again. Only universe-spanning walls would have universal repulsive gravity.

Domain walls, like monopoles and strings, have not been observed, though my personal suspicion is that many of them may have turned into quasars. There are tremendous numbers of quasars in deep space, and they are postulated to be driven by black holes. My graduate thesis advisor, Jim Ipser at the University of Florida, together with Pierre Sikivie, showed that spherical domain walls with a flat spacetime interior always collapse into black holes, and they would be whopping big ones, big enough to eat solar systems for breakfast just as quasars are purported to do.

Textures are a three-dimensional defect—an extended region of false vacuum—and are candidates for the creation of structure in the Universe. This type of defect, unlike the others, is expected to be unstable, rapidly collapsing in on itself at the speed of light, while spewing out tremendous amounts of energy in the form of Goldstone bosons, massless particles associated with quantum scalar fields. In the process of self-destructing, however, the texture—also called a "knot"—would create fluctuations in the density of matter, including galactic spheroids, which could then evolve into quasar-containing galaxies.

So far, textures, like the other defects, haven't been detected. This may in part be due to the fact that thicker defects tend to unravel as the Universe expands. Thinner ones would persist, though, and of course even the thicker ones could still be seen in deep space, which is equivalent to looking backwards in time. Some physicists are looking elsewhere for the perturbations needed to seed not only structures such as galaxies, but also, on a larger scale, the great voids and walls of galaxies. Currently, theories based on quantum fluctuations, caused by the Heisenberg Uncertainty Principle, are getting popular.

Shadow Worlds and the Multiverse

There is a final type of exotic Big Bang relic, and this is perhaps the most interesting and tantalizing possibility of all: other universes, even a foam of other universes.

This, in fact, was one of the original ideas of Alan Guth, and when I heard him espouse his theory at the outset of his work on his inflationary model of the Universe, I found it stunning and attractive. The Big Bang, rather than creating one universe alone, may have created numerous, separate universes, all of them initially out of contact with each other. Each of these universes would have had its own laws of physics, and while many would have expanded, others might have remained very small, in some sort of stable equilibrium.

While ordinarily these universes exist as separate, parallel continuums, they might occasionally collide—in which case, supposedly, we'd all be annihilated in a bath of Hawking radiation.

Some physicists think there may be

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millions of baby universes, perhaps even forming from evaporating black holes, and that as they recombine with our Universe they create gradual changes in fundamental constants of nature. There has even been talk in recent years of making a baby universe, right here in our own backyard. While such may be possible in principle—we'd need to create pressures and temperatures similar to the Big Bang in a very small spot—it's highly unlikely we could ever actually do it. We'd have to be able to compress ten kilograms of matter into the space of a proton, not an easy trick.

And, of course, it might be even tougher to survive the experiment, in the event we found a way to bring it off.

The idea that other universes exist, with different laws of nature, has led some scientists to speculate about shadow universes occupying the same space as our own Universe. It is conceivable that a totally different kind of matter exists which interacts only very weakly with ordinary matter, even less so than the ubiquitous neutrino, which passes through the Earth more easily than light passes through a window. This bizarre matter—call it shadow matter—could form planets, stars, and galaxies, but be completely invisible to us. If it interacted gravitationally with normal matter, it could account for much of the famous dark matter that remains one of the greatest mysteries of all time.

So the Universe—according to physicists, anyway—is populated with a lot of bizarre and interesting relics, most of them hiding out in deep space somewhere. Primordial black holes, quark nuggets, magnetic monopoles, cosmic strings, and domain walls—even baby universes. How much of all this is real, and how much is just the result of federally funded hyperactive imaginations?

That's hard to say, but when you think about the strange paradoxes of relativity and quantum mechanics—the twin paradox, the Casimir effect, and other oddities—you realize that even well-established science has taken a turn towards the bizarre. The late Richard Feynman, one of the great physicists of this century, once said: " . . . I think I can safely say that nobody understands quantum mechanics." Feynman, of course, won the Nobel prize for his work in that very area, but even he couldn't claim to grasp the foundations.

Our best current theories are terribly peculiar, virtually incomprehensible, and, in experiment after experiment, absolutely true. Chances are, the Universe is going to turn out to be a lot stranger than we think it is.

Acknowledgement

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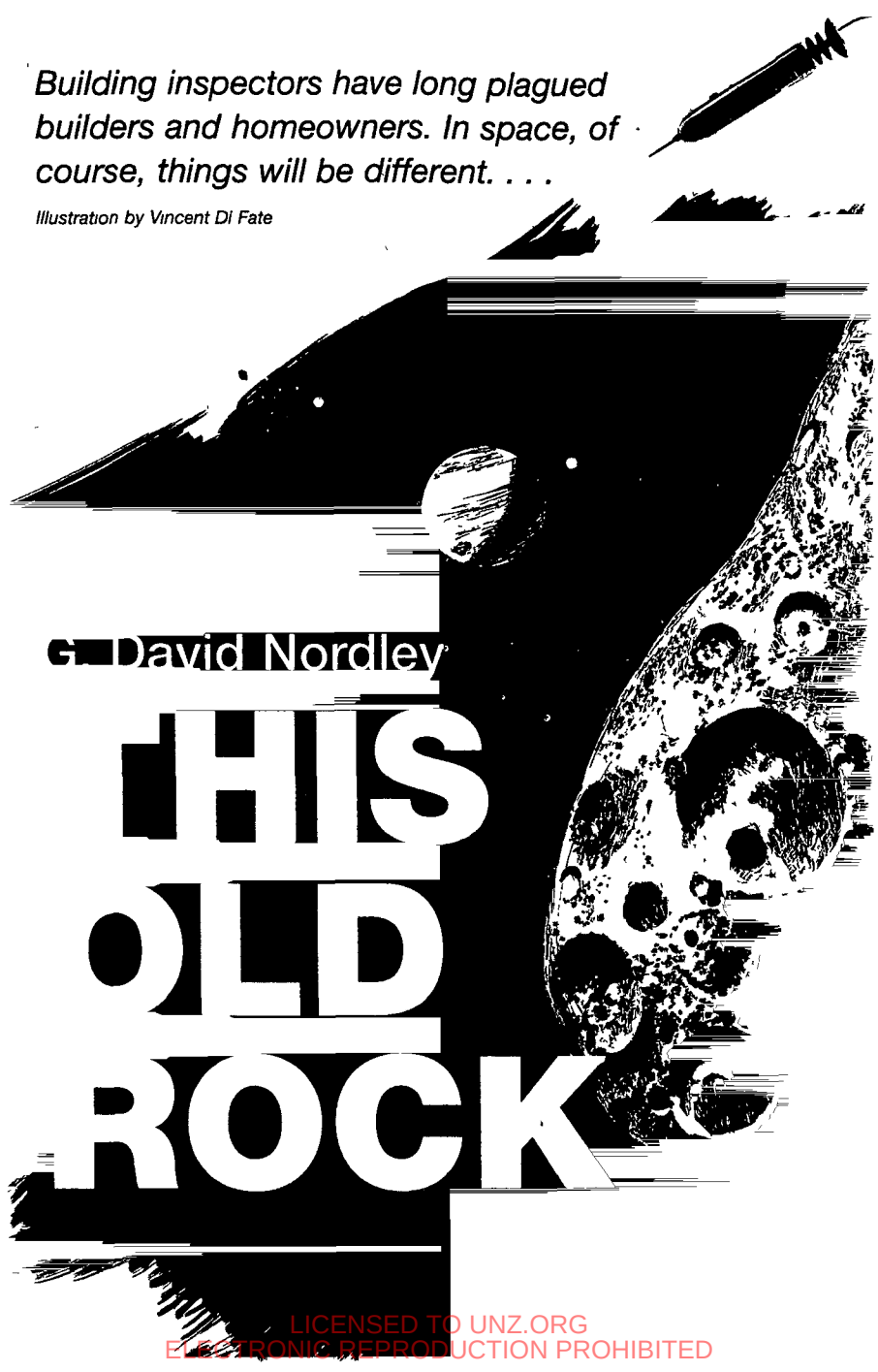
Building inspectors have long plagued builders and homeowners. In space, of course, things will be different. . . .

Illustration by Vincent Di Fate



G. David Nordley

THIS OLD ROCK

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"Damn bloodsucking tiny-skulled government bureaucrats!" Dolph Wigner yelled as soon as the link dropped and returned the *Hopper*'s viewscreen to a view of their peanut-shaped asteroid. He slapped the worn upholstery of the arm of the captain's chair in frustration. "Sasha, I think it's a conspiracy to make us buy more junk from the friends of these vampires on credit. By the time they're done, we won't own *half* of this rock!"

"Daddy?" a small, sleepy voice ventured from the compartment directly under him.

"What is it Tina?" he snapped, much too loud, he realized.

"What's wrong, Daddy?" she asked. "Are you mad?"

Tiny-skulled, Dolph realized, might sound like Tina-something to his three-year old.

"Not at you, Tina. Go back to sleep now, OK? Sweet dreams."

"What's wrong, love? It's one in the morning!" Sasha called from the ward-room below, which doubled as their bedroom. "Is Tina OK?"

"Tina is fine. I was just venting at whoever changed the requirement on the air lock door motors three months after our shipment left Luna! Forgot the time."

There was a rustle of bedding, and his wife made the easy one-sixth gravity jump up to the command deck from their bed—stretched her skinny, almost scrawny, body; yawned; and ran a hand through her long, wavy, hopelessly tangled black hair. He could see her bones; hell, he could see his own. They'd both been cutting way back on rations and working like demons for three months. But if they could just get approval, they'd have the old hydroponics system going and be eating their own tomatoes in another month or so.

"Can we afford the new motors?" she asked.

He smiled at her and sighed. There were many better things to do with the night than fight refurbishment supply problems. But every hour counted.

"If," he answered, "we can use the old ones, or sell them, the price difference isn't that much. The problem is that there's no way we can get them here in time for our inspection."

"They can't hold us to that, can they? I'm getting tired of this."

He nodded. "This" was hanging out in a cramped, smelly spaceship swinging around with its nose tied to the end of a hundred meters of tether when they had five hundred square meters of habitat that was ready to inhabit on the asteroid above them. But until they passed their inspection, they had three rooms, three meters in diameter by two-and-a-half high, with a head and an airlock at the top.

"Look, I can't do anything about it. It's the damn Interplanetary Association's rules, and if we don't follow the IPA rules, we lose the homestead. So don't vent me about it, OK? I'm sorry, darling." He immediately hated himself for snapping at Sasha. She was everything to him; the only part of the Universe that wasn't trying to stomp him. At twenty-four, he felt like a ninety-year-old curmudgeon with the

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world on his back, and sometimes it showed.

"But it's not our fault! They can't make us leave our homestead for something that's not our fault."

"I just don't know, Sash, I just don't know."

They were interrupted by a two-note attention tone.

"Go ahead, *Hopper*," Dolph told the spacecraft. He heard Sasha try to suppress a giggle. "Voice only," he added.

"We have an incoming message from an Inspector Eileen McCarthy of the local IPA Compliance Authority. She's C&C on Belt Runner four-one-two, a light-minute out from Pallas."

Almost here, then. So it was too late to get anything more done on the supplies or equipment. They'd pass with what they had, or not. "We'll see what she has to say later," Dolph instructed. "We've gone to bed. Acknowledge and record—I'll reply tomorrow morning."

"Yes, Dolph. I've sent the acknowledgment. Good night."

The command deck lights dimmed, and Sasha started pulling him down to their bed.

Two days later, Dolph took the tram cage up to the tether axis on the mast at the north pole of their rock. Well, not quite *their* rock yet, he reminded himself, though he had a lot of sweat equity in it. It was three kilometers across its longest dimension and Swiss-cheese-full of craters, the largest being the football field-wide hole at the top. They'd name it after Tina, they'd decided, as soon as they had the right to do so.

Below him was their habitat, deep in a hundred-meter cylindrical pit for radiation protection. A fifty-meter-radius squirrel cage of trusswork, it mounted a couple of big bent sausages and other equipment around its circumference. Above him was the great dish of their solar collector. A few kilograms of nearly perfectly reflecting flexidiamond aluminum sandwich almost two hundred meters across, it focused on a flat relay mirror. There was enough dust around the asteroid for him to trace the beam into the big black cylindrical converter at the top of the mast.

He saw few stars on his way up to the docking ring. Their pole was in sunlight, and would be for another year. He looked back toward the Sun. Mars was a reddish dot just far enough from the Sun to see if he shaded his helmet window. Earth, Venus, and Mercury were lost in the glare. Even when he looked away from the Sun, the sunlit structures around him banished any hope of dark adapted vision, mocking his mood with their unsoftened vacuum brilliance.

But Jupiter, now near opposition at the perihelion of the Pallas association, shone brightly against the black sky. Jove was over five times as bright as from Earth, and its four large satellites were clearly visible—he could even see the orangish tint of Io. Saturn, way off to the right, still seemed very distant, but the asteroid Pallas was brighter than Venus from here, and showed a tiny disk. Sirius, Procyon, Betelgeuse, Regulus—the brighter stars got through as well, and the effect was almost three-dimensional—

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he could image the planets on a plane stretching out toward infinity, with those few bright fixed stars set beyond.

Despite all the work and all the details of things to be removed, tested, repaired, replaced, and tested again, there was still a sense of wonder that he was out here—the descendent of apes with stone axes daring to live out here on the doorstep of all creation. He was going to do it. Somehow, despite everything, he was going to do it.

An instant and temporary comet got his attention. Inspector McCarthy's spacecraft was in the final stages of rendezvous, with thrusters flaring. Like their *Hopper,* it was a standard spin-electric rock hopper—essentially a smooth cylinder with a two-ring magnetic mirror plasma nozzle at the end—indistinguishable from *Hopper* on the outside except for the outsize volatile tanks mounted at its middle and the IPA insignia. It grew smoothly out of the dark and made the standard mast connection, nose in, rings out. Next to its connecting probe, a hatch swung in and poured out light. Into the light floated the black shadow of a space-suited figure.

"Welcome to 12478, Ms. McCarthy." Dolph gestured to the peanut-shaped carbonaceous chondrite below them. The space-suited figure coming down the mast to him was obviously female, of average height, and perhaps a bit hefty the way people too busy to exercise get in low gravity.

She put her helmet to the mast for a moment, then turned toward him, her face invisible behind the mirror finish of her helmet window. "You've got a sick stator magnet on one of your despin mast bearings," she announced in a no-nonsense, almost imperious tone. "I heard it screech after my dock."

Dolph opened his mouth, but couldn't think of a response.

The complaint was trivial, as far as he was concerned. The hollow despin mast held their main elliptical mirror and the docking fixture. Some torque on the despun inertial mast was inevitable as a ship docked, and it might momentarily cause physical contact in the bearing if one of the bearing magnets were a little weak; but if the mast was properly aligned with asteroid spin axis, that would vanish as soon as any transverse accelerations were damped. And the asteroid spin period was a leisurely eight hours plus; at that rate, the damn bearing could be made of taffy.

She, he decided, was deliberately picking a nit, maybe for psychological impact. Finally, enough time passed so that Dolph hoped he could just ignore the discourtesy.

"Any equipment you'd like to take down with you?" he asked.

"Did you hear what I said about the stator magnet?" she barked. "It's out of spec. Fix it!"

Damned if she didn't seem serious, he thought. This was not good. "I'll get on it as soon as we have you settled," he temporized.

"*Now,* Wigner. I don't want my ship torqued away if the bearing seizes."

Dolph opened his mouth to protest, thought better of it, and shut it hard

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enough that he heard his teeth click. Very well, he'd fix the damn thing. A quick check with *Hopper* identified the lower bearing as the problem, and he told *Hopper* to bring him the spare—a pair of thick nested hoops two meters in diameter.

"My wife, Sasha, is in the ship down-tether, waiting for you," he told the inspector. "I'll be done in twenty minutes or so."

"My ship's at risk and I want to stay here and watch this," McCarthy told him. "Get to it."

He looked up and saw her jet from her air lock to about ten meters out from where he was working, and take up a position with her back to the Sun. She crossed her arms and floated there, motionless on her backpack gyros. He assumed she was staring at him.

"Roger," he replied, trying to keep the irritation from his voice, nodded to her and got to work. The job wasn't that big, actually. One of *Hopper*'s spiders had brought the new bearing as they'd talked, and with smart fasteners decoupling themselves from the telescoping joint, all he had to do was ease out the old bearing and ease in the new one before light pressure on the solar collector pushed the mast out of alignment by more than a centimeter.

He had it done in fifteen minutes.

"Can we go in now?" he asked. "Sasha's holding lunch."

"She'll have to hold a bit longer." McCarthy jetted over to the mast and held her helmet against it for a long time, then seemed to be satisfied. Dolph told *Hopper* to feed their conversation to Sasha so she'd know what was going on.

"Twenty-first century?" McCarthy asked at length.

"Early twenty-second," he replied evenly. "It's an old Cislunar Republic mining survey station for the twenty-fourth Kirkwood association, last inhabited in 2123. The CLR left when Mercury opened up."

"I know all that," McCarthy snapped. "I date things by when they were built, not when the last people left. That shaft is a hundred years old if it's a day. No later than 2092, I'd say; it's titanium, probably lunar. They punched out hundreds of these setups back then. Anything after that would have been local glass, because that's when the rock chewers got smart and fast enough to make it cheaper. You did the joint yourself?"

"Yes. The original bearing is down on the crater floor. Wouldn't move."

"Vacuum welded. They used glazed rollers—OK for a few years, but you have to keep them moving. I won't redline your job, but that magnet going sour was a symptom that the thing's been wowing a bit. You put a large mirror on that shaft."

"We're going to grow grapes, so we got as big a mirror as the specs allowed—"

"And, to save money, the smallest bearings," McCarthy interrupted. "And on top of that, you put it as far up as you could. Everything away from the direction of goodness. Maximum stress: not smart."

"It computed, Inspector."

"Tell me about it," she sniffed. "Artificial intelligences lack both art and

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intelligence. Look, I said I won't redline your provisional on that alone, but you'll need to fix it, understand? I know an outfit at Chao Dome—"

"Mercury!"—*I'll bet you do,* Dolph seethed. But he said: "Yes, Inspector. Why Mercury? Mercury is as far in to the Sun from here as you can go!" She wasn't even inside yet, hadn't much more than glanced at the habitat, now they were already looking at nine months for a shipment from the South Pole of Mercury, and paying probably another EU to get free and clear of the IPA bureaucracy. Damn! They could have lived for a year on Mars for an EU.

"Mercury is the nearest solid thing to the center of the asteroid belt," she said. "Think about it. With their electromagnetic launchers, delta-v is beside the point, and Mercury revolves around the Sun so fast that it's never more than ninety days for a launch to any place in the belt. Now, what's your problem with Mercury? You don't like their connections?"

What the hell? Dolph thought. Was she reading his mind, or had she just been through this with so many newcomers that the question was second nature? He considered the question rhetorical and acknowledged the lecture with a negative grunt.

McCarthy gestured to the crater below. "Standard turn of the century habitat down there?"

"Not any more," Dolph snapped, then stared at the habitat as he counted to ten.

The crater was four hundred meters across and almost precisely on the asteroid's spin axis. The habitat centrifugal frame, an open lattice box of cables and tubes as long as a football field and half as wide, could rotate in the crater like the spinner on a child's game, giving them lunar normal acceleration at the tips. It was static now, though, to make their work easier; the asteroid's minuscule gravity was enough to hold tools and supplies on the habitat walls. He and Sasha had spent the last two months turning living quarters originally meant as spartan accommodations for a dozen survey personnel into a comfortable home for three, following the requirements stored in *Hopper*'s cybernetic brain to the bit.

"Hmmpf. I suppose not. I see it has the old-fashioned gas retention vestibules outside of the inboard air locks."

She meant, Dolph realized after a vocabulary-searching second or two, the enclosed porch around the main air locks; the ones that would be on "top" of the two habitat modules when the frame rotated, i.e., toward the center.

"That's a good feature," she added, almost inaudibly. Then she cleared her throat and asked, clear and loud: "Did you restress the angular momentum neutralizer?"

"Huh?" How, Dolph wondered, did you neutralize angular momentum? Wasn't it conserved? What kind of state-of-the-art electronic device would he have to buy now? "What the—"

"That's the big stone wheel under the frame that turns in the opposite direction. It cancels your habitat's angular momentum, so your habitat rotation doesn't cause the asteroid to

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precess and swing your mast around and wreck your new bearing. Now, did you tighten the cables that hold it together?"

"*Hopper,* what about it?" Dolph asked, thoroughly confused. The floor under the habitat was a circle of smooth solid rock—he hadn't realized it could turn.

"My IPA download," *Hopper* replied, "makes no mention of reviving the momentum neutralizer, nor of this procedure."

"Idiot bureaucrats!" McCarthy huffed. "I filed that requirement two years ago!"

"Uh, is that wheel really necessary?" Dolph asked. Maybe there was a reason it wasn't in the book, the reason being an opportunity for selective enforcement. He supposed the next thing he'd find out was it would cost another EU to fix. "I mean, if the mast alignment is accurate enough—"

"*If,*" she interrupted. "On a rock this small, the first stray meteoroid big enough to get through your laser deflectors will knock it out of alignment. And *that*'s assuming it was accurate in the first place, which, from what I've seen so far, would be asking a lot. Look, what you have to do is clear the gap between the wheel and the well walls, float the whole assembly out, check the tension on the wires that run around it, pull the bearings apart, nanoplane them, and repack them with buckyballs. Take you a day."

Inspector McCarthy raised her hands and put them down again in a clear gesture of disgust. "All right, Wigner, I've already seen enough to spoil my appetite, but let's go out to your ship anyway."

"No," Sasha sent on their private line, "not like that. Calm her down first, I don't want her to scare Tina."

"Sasha . . ." Dolph pleaded. The last thing he wanted to do was insult the testy Inspector. Maybe . . .

"No argument on this: my call, darling."

Dolph took a deep breath. "Uh, Ms. McCarthy?"

The woman turned to him. "*Well?* What is it?"

"We, uh, have a three-year-old girl with us. Uh, her name is Tina. Angry people frighten her. Could you. . . ?" Leave the shouting act for the adults, he wanted to say—but he choked that back. Temper, grace.

"You *what?*" Inspector McCarthy sounded shocked and confused. "What is a child that age doing out here? Why wasn't this in my briefing?"

Dolph closed his eyes and counted to ten again. "Inspector, she's in our records. Born at L4 Von Braun station. The *Hopper* is family rated."

"For transportation! Not as a nursery! Why didn't you leave her with her grandparents or something? Until this job is done?"

Was there any way, he wondered, that he could space this screaming harridan and get away with it? His past and their problems with their parents were none of her damn business. Since when did a habitat inspection become an excuse to cross-examine someone's life? Or was this an attempt to provoke him, make him do something like what he was supposed to have done on the Moon that would

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let some big belt corporation step in and take the asteroid that was all they owned.

"We wanted her with us and nothing in the IPA rules said we couldn't take her."

"You didn't ask?" The inspector sounded incredulous.

"Ms. McCarthy, one of the reasons we came out to the Belt was to get away from having to ask. About everything."

Eileen McCarthy rotated to face him, a silent cipher behind a shiny faceplate.

"One of the reasons? What did they do to you kids to make you risk *this?* No," she held up a hand, "You're right about that. I don't need to know your past. The kid's out here now and we'll just have to deal with it. Some would say that it's maybe better that way, if the whole family goes at once. Let's go down to your ship." She got in the Tram cage for the two-and-a-half-kilometer ride out to the *Hopper*.

Out of her helmet, Inspector Eileen McCarthy looked as formidable as she sounded. Her curly hair was as steel-gray as her manner. Her slight excess mass softened her face to a degree, and the one-sixth gee of the tethered spacecraft did not tug the features down as much as they would on her native Earth. Otherwise, Dolph thought, the hook nose and down-turned lips would have evoked some costumer's idea of a witch. He tried to imagine her as someone's lover, once upon a time, and failed.

She wrinkled that large nose as soon as her helmet came off when she emerged from the air lock into their bedroom/wardroom, "Child," she said to Sasha, "you need to take the lenses off the air-cleaning lasers and polish them occasionally. The automatic systems you have can't get at them, and, in this low gravity, they develop a film that blocks some of the most effective frequencies. Surface tension effect—take a microscope to them some day and see what I mean."

"Ms. McCarthy—" Sasha began, a note of outrage in her voice. Dolph held up a hand and shook his head vigorously. Too much was at stake to risk offending the offensive. Sasha, fortunately, caught the hint. "We've been a bit busy. I'll get to it before you come back. Anyway, you're welcome to share a meal with us."

It wasn't much—a plate of protein biscuits and three narrow-necked, low-*g* water glasses.

Inspector McCarthy ignored it. "You want to live out here all alone? You learn to be very careful. Yes, you're in the Pallas association, but most of the time, you'll still be a week or two away from any physical help. Hell, most of the time you kids will be too many light-minutes away for anyone to even use your computer's motiles interactively. We may have retroviruses to make our genes radiation tolerant, but the bugs and viruses we take with us have no such luck. They mutate. Cleanliness is a survival skill. While I'm at it, my briefing said you're going to mount your A.I. on an Opticor 721. Tell me it's not so! You ought to have one of ICA's double N thirty-sixes."

Sasha shook her head. "We could

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get *three* 721s for the price of one of those. . . ."

Inspector McCarthy scowled.

Sasha smiled. "So we did."

McCarthy looked surprised and almost smiled—at least Dolph thought he could detect some movement in the deep crevasses that emanated from the corners of her mouth. Then, without saying anything more, she sat down, reached for a protein biscuit, took a bite and chewed. It was so quiet that Dolph could hear her crunch the flavor nuts between her teeth.

Finally she swallowed, lifted her glass of water, watched it slosh around a bit, drank, and nodded. "I'll give you a marginal pass on that. I like redundancy, excess capacity, and graceful degradation. Mind you, three double N thirty-sixes would have been better."

Tina chose that time to come out of her compartment, swinging from the handholds as was her custom, so that she could look adults in the eye. They kept her hair short, for convenience and her favorite nightie was a brown flannel jumper—nothing really abnormal, but the total effect could, Dolph realized all too late, be distinctly simian.

She also needed a changing, but before he could do anything, Tina swung over to the wardroom ceiling above and in front of Inspector McCarthy, directly over her plate, and shyly mumbled, "Hi."

What was most noticeable in the following seconds was the growing color in Inspector McCarthy's hitherto pale cheeks as the smell wafted about. "Do you," she choked out at length, "ever discipline this child? What exactly are . . . *her* behavioral limits?"

"Hi?" Tina repeated in a small uncertain voice. McCarthy had used, Dolph realized, at least two words that were not often used in the Wigner family. He and Sasha were determined to be as not like their parents as they could.

"Tina," Sasha began, conversationally, "hasn't mastered low-gravity toilets yet, but she's working on it, at her own pace. Aren't you, darling?"

Tina pouted. "I'm Tina, not 'darling.'"

Sasha beamed indulgently. "Tina, this is Inspector McCarthy, who will be helping us get our new house ready."

"Hi?" Tina repeated. "Are you a which?"

Inspector Eileen McCarthy wrinkled her nose, took a deep breath. "Hello, Tina." Then she reached up and pulled the child from her handhold.

"Let me go, you which!" Tina protested.

Inspector McCarthy handed her off to her mother with a suffering look. Then she turned to Dolph. "When you are both working on the habitat, where is she?"

"She comes with us," he replied. "We modified a rescue bubble into a sort of nursery, which she used until we pressurized and—"

"Let me," McCarthy groaned, "see if I understand this. She's allowed to float around wild in a habitat under construction among the motile spiders, laser welders, nanoplaners, and so on? And she's still *alive?*"

"We have a net around her," Dolph snapped. "It works fine."

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McCarthy shook her head. "Did it ever occur to you dear young people to ask for some help?"

"As you pointed out," Dolph answered, trying to keep his voice even and conversational, "we are normally several light-minutes from any other habitation. And there's no more money."

McCarthy frowned and pushed herself up from the table. "I can see that. You've been cutting back rations. I have an extra fifty-kilo CMF standard—I'll send a telop down with it."

Sasha shook her head, "We can't—"

"Did I ask? You can't feed the baby that way if you don't feed yourself."

Sasha's face turned red and her smile got very tight.

How, Dolph wondered, had this old biddy known Tina was still nursing? And what business was it of hers? His indignation began to rise, but he thought better of it. Fifty kilos of vacuum-dried food would keep them going for two or three months, if they stretched it. He was in no position to object. "Thank you, Inspector McCarthy," he finally choked out.

"Hmmpf. We will start inspecting this supposedly childproof habitat construction site at oh eight hundred tomorrow morning. I can find my way back to my ship."

In an embarrassed silence, she put her helmet back on and cycled out of the lock.

Sasha's face fell as soon as the door hissed shut, and she began to sob. Dolph put his arms around his wife and child.

"Oh, *oh!*" Tina squeaked, realizing something was wrong.

* * *

The inspection was a disaster. By the end of the day, there were some thirty-three items which had to be fixed before provisional approval, and another seventy-two that needed to be corrected by final approval. It seemed to Dolph that McCarthy's sole purpose was to prevent them from occupying their asteroid and when it seemed that no amount of appeasing her would slow the accumulation of items on the list, he'd allowed himself, in desperation, to argue. At this rate, they would have to vacate before they even got to her gift rations. Maybe that's why she could be so generous—she was going to get it back anyway.

Finally, Dolph blew his gasket. The vestibule air seals had been the final crack in the air hose, so to speak, and Dolph's feelings had gushed out as they shut the inner door and stood in the bright, clean, sweet-smelling entryway to the home that Dolph was beginning to realize would never really be his.

"Ms. McCarthy," he wailed, "those seals are in spec! All the vestibule is supposed to do is to guide the last wisps of air from the air lock to the ion pumps so you can open the door sooner. It's never *supposed* to hold any real pressure. It's *not* a backup system!"

"A seal is a seal. You never know when you might need it."

"Damn it! I'm going by the book and the book says IPA certified pipe is safe to use outside as is!"

"The book, young man, says inspectors are to use their judgment,"

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she said in as frosty and imperious a tone as he'd yet heard her use, "and my judgment right now is that you have an attitude problem; not toward me—while I can see that, too, it's irrelevant. But you aren't attacking your problem. You're just filling squares on the list—not thinking, not being proactive. This isn't a chore you kids have to do—it's your lives, and you don't seem to realize it!

"Specifically, here and now, I don't consider your vestibule seal installation adequate and I don't consider your piping installation adequate."

"But by the book they are! And I'm going to damn well appeal this, and your fix-log on the door motors. I got the certified equipment, certified materials, installed them with certified procedures, and you redline it! I don't know what your game is, whether Shan Toy's parents are paying you, or some people that want this rock without taking the trouble to settle on it, or some politicos that don't like people running around outside the grip of some power structure they can control—but it's not fair!"

"Neither," she said, so softly that he had to concentrate to hear it, "is death."

"Is that a threat? Because if it is, I'll fight back, and if you don't think so just ask—"

"I know who and what to ask, Dolph Wigner. I think we're done for today."

It was over, Dolph thought. Maybe he could get enough for the rock to get Sasha and Tina back to the Moon. Her parents would take her in, and Tina. But he would have to stay out here . . . doing what? It took a minute for McCarthy's words to sink in.

"For today?"

"We've inspected the air lock and the interior utilities of half of your habitat. If you will stipulate the same fix-logs on the other half, we should be able to work on the structure tomorrow."

"Why? You've already ruined us and redlined us back to the Moon; why continue?"

"Wigner," Inspector McCarthy said, coldly and evenly. "You have the right to try to correct the redlines on the spot. It just so happens that I've brought some materials along with me."

"Available for a price, no doubt."

Inspector Eileen McCarthy looked at him and raised an eyebrow. Then she reached for her space helmet, put it on without further word, and left.

"*Hopper,*" Dolph rasped, his voice halfway between raging and sobbing, "send a message to legal assistance at, at . . ."

"Pallas would be closest," the computer answered.

"Fine. Send a transcript of the last ten minutes of conversation, and ask for help in declaring these fix-log items invalid."

Maybe there would be some fairness, somewhere. He had to try everything, he realized. He couldn't bear to lose Sasha, not for one lousy stupid mistake. Or two, or three, he corrected, bitter at himself. They wouldn't be in this mess if it weren't for his mistakes, he knew. It wasn't all Inspector McCarthy's fault. But, dammit, they needed a break, not another problem.

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* * *

His answer came at dinner, a very quiet dinner, that night in the wardroom of the *Hopper*.

"Put it on the wall here," Dolph said.

"The caller suggests a private conference."

He looked at Sasha, who simply reached over and touched his arm. "Use Tina's room. I'll put some music on in here."

He nodded and got up. They'd made Tina's room by putting a flat wall across the wardroom one meter from the wall. In the space between the straight inner wall and the curved outer wall was a half-meter wide child's bunk, a compact wash stand, and a video screen.

"You forgot to say 'excuse me,' Daddy," Tina chirped. She'd started chattering at twenty months and hadn't stopped. He was afraid to get her IQ tested.

Dolph rolled his eyes and managed a pained smile for his daughter. "Excuse me, Daddy."

Tina looked confused for a moment, then giggled and said. "No, *you're* Daddy. You're excused, but you have to come back for dessert!"

"Sure, Tina." He ran his hand over her hair.

He covered the distance to the compartment door in one low-gravity stride, as one of Sasha's bouncy moonjazz compositions started with her characteristic three dissonant chords which resolved into walking scales under a high riff. A century ago, he thought, her talent would have been a ticket to independence. Not any more. Her stuff was good—but with thirty billion people on Earth and another three scattered among the other worlds, and almost all of them with all the leisure time they could want, there was a Solar System full of good stuff out there.

The door slid shut and cut it down to background—a centimeter of basalt foam was a good sound insulator. He knew damn well what the lawyer wanted to talk about, and it wasn't for Tina's ears. So he sat on her bunk in between her stuffed animals, with her crayon drawings taped to the wall for a backdrop, and faced the video screen, which dissolved into a holo of a distinguished-looking balding man in a white turtleneck with an pointed black beard just starting to turn gray.

"Mr. Wigner, Jaynes Femrite. I'm with Femrite, Carson and Lu, doing pro bono for IPA Legal Assistance. I understand Eileen's giving you her, uh, best."

Eileen? Dolph shook his head. Did *everyone* know everyone out here?

"I'm about at the end of my rope, Mr. Femrite. Her standards are a moving target. I've met all the legal requirements, all the specifications, and I can't get from here to there with her. We just don't have the money to pay her, and all her friends, for everything she wants us to buy from them." He took a breath. "We don't want to cause trouble. We just want to be left alone. But I have to do something. We can't go back and we're within a month of being self-sufficient here."

Femrite inclined his head slightly. Dolph saw the "secure comm" telltale

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in the corner of his screen. Could he trust it? Did he care anymore?

Femrite cleared his throat. "Got yourself in a little trouble back at Shepard City, didn't you?"

Dolph looked down. So the guy already knew, and so did everyone else. That was probably another reason for "Eileen" to hound him out.

The lawyer waited a minute for an answer, but when Dolph didn't say anything, he continued. "Her name was Shan Toy. Want to tell me your side of it?"

Why not, Dolph thought. What more harm could it do? "I'd just finished a three-week mine engineering school and was celebrating. She picked me up at the bar. I didn't know how old she was, didn't even suspect because she came on so, so mature. I told her I was married and she said 'so what, it's just for a night.' So we checked our records and went to my room.

"We were just getting into it when she complained about my ring hurting her back so I took it off and put it on the nightstand. It was my great-grandfather's college ring, with a hand-cut diamond in it. She apparently suspected what it was worth, because as soon as I set it down, she jumped up, grabbed it, and headed for the door.

"I went after her and she pulled a gun—I don't know from where. I kept after her anyway because the ring meant so much. She shot once and missed and then I was grappling with her and the gun went off again. The dart got in between the vertebrae in her neck somehow and the trank shut her heart down. It was a freak accident. I ran, then came to my senses and realized they could trace me a hundred ways. So I called Sasha, and turned myself in."

The lawyer nodded. "Self-defense, hung jury on the murder charge. Parole with time served on the attempted statutory rape charge—you could have checked her age."

"She said she was twenty, right from Earth on a tourist visa with her parents and five sisters. I was drunk and fell for it. It turned out her so-called parents weren't even related to her and they both had rap sheets in Thailand. The girls were supposed to sell themselves, or get in someone's room and grab something valuable. Preferably both. I wasn't thinking . . . damned stupid."

It had been the most miserable episode in his life, and he felt like he had used up a lifetime's worth of emotional self-control getting through the hearings. He stared at Femrite. Enough was enough. The Universe had to get off his back sometime.

Femrite raised an eyebrow. "But the court of public opinion wasn't so kind?"

Dolph sighed. "Her parents and the tabloid media said I made up the ring story. Dad was mad as hell. He gave me a grubstake, pointed me at the Belt, and told me not to come back. Sasha's family tried to keep her at L4, but she stuck with me. That was all that counted." Damn it, his eyes were getting wet. That big knot in his stomach, that had been there ever since Shepard City, got a little tighter. Get a grip, he told himself. "Until now."

"Uh, huh," Femrite agreed. "That

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counts for a lot. That and your daughter. Look, I want to set you clear on a couple of things.

"First is that Eileen doesn't care what your past is. That's usually the case in the Belt, and there are minuses as well as pluses to that. For instance," the lawyer flashed a shark-like grin at Dolph, "you'll probably end up doing business with a certain former drug dealer with a manslaughter rap which, they say, included cannibalism. He's behaved himself since getting out here. Of course people take care not to rile him." Femrite's grin was distinctly chilling. "At any rate, *your* crime is small potatoes out here, even if you're lying about what happened at Shepard City."

"Lying!" Dolph couldn't think of anything to say. Then anger turned to uncertainty, tinged with fear. He wondered if the drug killer was named Femrite.

"Now don't get mad. I said *if*, and, in fact, I think you are being truthful. But my point is that all that's irrelevant. What counts now is what you do out *here*.

"The second point is that, out here, what an inspector says, goes. We don't, and can't, have the public infrastructure with all the appeals you're used to. Even with robotics and beam propulsion, the rocks are too far apart. Rescue missions use up a lot of human resources, and we can't do hundreds of them a month. We're a community out here, and while we scratch each other's backs a lot, we want time for our own lives. We don't have a lot of laws and not much to litigate; almost a million people now and only a couple of dozen lawyers. So forget torts; you have to take care of yourself.

"And yes, we buy local and favor those who do. We know each other. The belt runs on a lot of handshakes and understandings. That's just the way it is.

"Now, Eileen's not that unreasonable. She might be willing to ameliorate some of these fix-it log items that you're complaining about, but the main requirement—" the lawyer's voice took an icy edge "—I say the *main* requirement for not having the Interplanetary Association ship you out as a menace to yourselves and anyone that might have to rescue you, is that *you pass inspection*. There's no appeal to that. We're a pretty independent lot, so we don't choose inspectors at random. Am I clear?"

He was clear, but Dolph had to ask anyway, just to rub in the unfairness of it. "No appeal? No legal recourse?"

Femrite threw up his hands in apparent exasperation. "If, and I mean a big if, we could prove pecuniary bias on Eileen's part, you could get reinspected by someone else. But you can imagine what the next inspector is going to think about your filing such charges against Eileen McCarthy!"

"I thought," Dolph said lamely, "some people from the Moon might be using their influence on her. Or someone who wanted the rock; second mineral rights or some such. You hear a lot about that kind of conspiracy thing on the university."

Femrite nodded. "That you do. Conspiracy is the sophomore's favorite religion—kids want to believe

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that things happen for a reason, even if it's a bad one." He sniffed. "They learn. Anyway, Eileen's not one to be influenced by anything like that—quite the opposite, I'd say. Try to push that woman and she'll push harder in the other direction."

Dolph couldn't suppress the flicker of a smile. *That* he could believe.

"Of course," Femrite continued. "I'm obligated to file a protest and represent you if you insist."

Dolph glanced at the floor. So a protest would be useless and it was nobody's doing in specific. So the whole Universe was a damn conspiracy against him and he had no rights, none. He'd lost anything resembling rights back on the Moon when he tried to take back great-grandpa's ring. "No, Mr. Femrite," he sighed, defeated. "No protest. I've got the picture."

Femrite shook his head skeptically. "Well, I'm not quite sure of that, but it's the best I can do. Good day, then."

Just like that, his hope of doing something about this miserable, unfair ordeal vanished. Dolph found himself staring at a blank wall in pitch darkness—the room's only window, near the *Hopper*'s shadowed south pole, looked away from the asteroid's bright horizon. He didn't ask for lights, but looked out through a meter of clear shielding water toward the stars. As his eyes adapted to the dark, the zodiac became visible, each ancient animal sliding by his view every fifty seconds as the ship swung around. The Milky Way passed by with Sagittarius, a bright river with dark clouds here and there. Constellations became harder to recognize as more and more stars confused his view.

Gradually, at the limits of his vision, the Belt itself emerged, its trillions and trillions of tiny pebbles reflecting enough light to make a broad, ghostly band—once his refuge, now, apparently, a nest of callous enemies. Involuntarily, he clenched his fists. Then, faintly imposed on his view of the cosmos, he saw the reflection of his own starlit face.

The door of the room hissed open and glare flooded the room. He turned.

Tina launched herself into his arms. "Dessert time!" she piped. "Why are you crying, Daddy?"

Sasha was polishing seal flanges when Dolph returned from the next day's structural inspection. She'd fixed one of the flat rings to a table and another to a block of basalt glass and was rubbing them together, slowly turning the top block as she stroked. McCarthy had just put another dozen critical items on the fix-log, he was numb with disappointment, and there Sasha was—polishing seals by hand.

"What are you doing?" he asked, as if he couldn't see. What he had meant, of course, was "why?" Any effort at all seemed to be futile.

"I called Inspector McCarthy last night to ask what they did to seal flanges to make them acceptable to her, and she told me. I thought it was something I could do myself, by hand, with the ones we've got. You see, they'll fit exactly with a little curvature if you polish them together, and still come apart without damage. It's

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like making a telescope mirror."

"I think you're wasting your time."

She shrugged. "Probably. But I had to do something physical. I also checked on who has secondary claims on our rock while you were out."

"Anyone we know?"

"Ever hear of Cistrojan Enterprise Limited?"

"No."

"Neither did I, but I cross-checked the media file and there was an article on a mineral rights mess they're involved in. Guess what law firm is representing them?"

It didn't take a rocket scientist to make that guess. "Femrite, Carson and Lu?"

She nodded.

"Everyone knows everyone out here." He groaned. "They're going to run us out and take our equity!"

Sasha shrugged her shoulders. "Maybe. Darling, the way I see it, we have two options."

Dolph gave her a twisted smile. "Go ahead."

"We can always run. Or we could call Inspector McCarthy's bluff on the fix-log."

Bluff? McCarthy seemed pretty sincere to Dolph.

"How so?" he asked.

"Start fixing the stuff on site. Ask her to stay until it's done and play on her sympathy."

"She could just set a deadline, leave, and kick us out if we weren't done by then. And what sympathy?"

"Dolph, she gave us the food. I think she's been trying to keep the door open a crack, in spite of everything." Sasha sighed and brushed a strand of hair from her eyes. "If we just look at things her way and try to make things better wherever we can. . . ."

Dolph shook his head. "Sash, it's a tremendous, heartbreaking amount of rework. And we already did everything right! Everything!"

"I know, darling. But as far as I can tell, it's the only chance we've got left. Let's not shoot ourselves down. If she's going to pull the trigger, call her bluff and make her pull it. Until then, if she wants things fixed, let's fix them! Make it a war of attrition; we're younger than she is."

Dolph didn't know if he had the energy to get out of bed in the morning anymore, let alone fight a war of attrition. But if it meant a chance to stay with Sasha and Tina, a chance to start over . . . "OK, darling," he finally muttered. "I'll try again, for you. I'll try—just don't ask me to hope."

Sasha put her arms around him, and they held each other until Tina started asking for dinner.

Inspector McCarthy looked at her reflection in the polished seals, then set them down on the wardroom table. "By hand?"

Dolph inclined his head to Sasha, who answered. "I got them out myself and did them like a telescope mirror. They fit to a quarter wave."

McCarthy shook her head, but said "Very well. Let's see how they work, and if they're OK, I'll take them off the fix-log."

"I'm going to restress the angular momentum compensator tomorrow, Inspector," Dolph offered, keeping his voice as neutral as possible, "And

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we figured out how to get *Hopper* to pressure test the air pipes autonomously, linking with one of the spare habitat brains."

McCarthy raised an eyebrow, then looked at her comp. "There are now over a hundred items on the provisional approval fix-log. And I don't have an infinite reserve of time."

She seemed to think for a long time. No one said anything.

"Hmmpf. Very well. If you do the work right, at least the next tenants can benefit. I'll give it another week, and we'll see where you are then. We'll start again tomorrow morning at oh-eight-hundred, inspect anything you've done in the meantime, and advise on work in progress. Agreed?"

They nodded and she reached for her helmet. But before she put it on, she turned.

"One more thing. I need some gravity—for the bones, and the regularity. Modern medicine can do a lot, and I lift 500 newtons daily, but they say that one should have at least lunar gravity after ninety. Digestion more than anything else. My ship shall replace your counterweight. My ship's computer can handle the slip clutches, so you won't notice it. Good evening."

With that, she cycled into the air lock.

Dolph found Sasha staring at him. "Ninety?" she whispered.

He gave her a grim smile. "Over. That's over twice our combined age; maybe we *can* outlast her. I'll go up and do the angular momentum compensator tonight while you bathe Tina. Then you can go up and install your seals." He thought a moment. She'd be outside a long time doing that. "You should replace the external suit air lines, too. They're your backup and the old ones are brittle." A century ago they'd used some kind of polymer that had dried and hardened in vacuum and cosmic radiation. They'd bought new basalt fiber composite air hose that was more flexible and would last longer. He felt better, now that his mind was back on the job. Hopeless as it might seem, there seemed to be something he could do about their situation, and something was a lot better than nothing.

"Darling?"

"Yes, dear."

"Work slowly and get it right; don't give her an out, huh?"

Dolph shrugged. "Yeah, I'll try. Sometimes I wonder who we're working for, but I think you're right; it's our only chance. While I'm out there on the wheel, see if you can find a bio on her. I suspect her maiden name was Murphy."

Sasha looked a question at him.

"As in Murphy's law."

Sasha smiled. "You've got your sense of humor back, love."

Three days later, they were on the top floor of the habitat replacing the air lock inner door seals. Tina floated in her net "cage," and propelled herself around like a tiny rocket by throwing stuffed animals at the nets. Inspector McCarthy was in her usual humor, only this time, for once, her pique was not directed at Dolph's work.

"How can they possibly send this stuff? Look at this pipe!"

Sasha's hands were full of Tina, so

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Dolph floated over to take a look. He couldn't see anything wrong, but knew better than to say that. Instead, he asked:

"What do you see?"

"Not see, feel. Longitudinal cracks; feel how the fibers bristle along this line. There's a microscopic crack; I'm sure of it; the top layer of broken fibers pops out of the matrix in this stuff."

She handed the air pipe to Dolph.

About two centimeters in diameter, the basalt fiber composite was very light and had good tensile strength—but otherwise it was very flimsy. In use, it would be stiffened by air and be almost indestructible. But limp? It could be cracked easily. He ran his fingers around the tube. Sure enough, while the clean white surface looked perfectly normal, he could feel the faintest bristling where Inspector McCarthy said it was.

"I don't understand how this could happen in the manufacturing process," he said. "The robots would catch it." Something more was bothering him, however. Had they already used some of it? No, he hadn't, he was sure of that. But something was nagging him.

McCarthy shook her head. "Probably happened later. Maybe the shipment got overstressed on deceleration. I swear some of the still loaders pile stuff on like they're going on milligee ion rockets instead of quartergee beam riders. Tubing should go on end, not flat. Who knows what they did?" She shrugged. "But I strongly suspect this will fail a pressure test."

"And you just happen to have some more in your rock hopper."

McCarthy shot him a look. "In this case, young man, I don't. But you might have an equivalent in your rock hopper's spares. As long as you aren't flying anywhere, you can share spare stores until a new shipment gets to you. And there might be enough good stock in this lot to do what you need if you don't have any more breakage. Just check it thoroughly, understand?"

Dolph swallowed his irritation. She was not the enemy. "Yes, Inspector McCarthy."

Dolph looked down at the backup valve assembly in his hand. It was a simple job to replace the old electrical wire connector with the fiber optic replacement transducer, but an especially significant one. It was, after four weeks, the last class one item on Eileen McCarthy's fix-it list. There were still forty-some class twos, but she'd been making sounds like she wouldn't hold them up for those. Getting tired of her game, Dolph thought. Damn it, Sasha had been right—they'd worn her down. Or maybe Inspector McCarthy figured she'd gotten what she wanted out of them—and it hadn't, after all, been the asteroid. Compliance? Attitude? Maybe the whole thing was just the Belt government's way to show him and Sasha who's boss—to get them on their backs with their feet flailing the air like a couple of beaten dogs. Some people got off on power that way—the good news about that was that maybe they wouldn't be run off the rock after all. No people, no power.

"Darling," Sasha called. "Would you put Tina back in her cage?"

Dolph turned around and saw Tina

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crawling under the netting. He couldn't hold back a grin. The kid had figured out how to work open the carabiners holding the net to the stick-on cleats—she was smart. "No Tina," he said with some soft authority in his voice. "Go back. Inside."

"I don't want to. Want to see *Mom*my."

Hungry, Dolph thought.

"Oh, I'll get her, darling," Mommy responded and anchored her tools to the Velcro work pad and pushed herself over toward Tina.

The bang was not particularly loud, but Dolph knew, instantly, that it meant trouble. The scene froze in his mind, then started to move forward slowly. What to do? What to do? A sharp keening built up from somewhere off on his left.

"We have," *Hopper* announced, "loss of pressure in the external suit fill line."

That's what he'd been trying to remember. Damn. "That faulty pipe!" Dolph yelled.

"What faulty pipe?" Sasha said.

She hadn't heard—she'd been busy with Tina.

"That white two-centimeter composite. It had cracks."

"Damn!" she said, but softly. "I used it to replace the vestibule air lines—you said . . ."

As if to confirm that, there was a resounding clang as the vestibule's external door slammed shut.

"*Hopper,*" Inspector McCarthy said, loud, but calmly, "shut down the suit fill circuit."

"The break is upstream of the shutoff valve," it replied.

"At the source, then," she added quickly.

"I show no response to the valve command."

"Crap!" Dolph shouted. "Of course you don't. I have it off for testing."

"The vestibule pressure has reached point four atmospheres," *Hopper* reported.

That was a tenth atmosphere *above* the interior pressure, Dolph realized. Sasha's gaskets were holding with a vengeance, but if it kept going on up to line pressure, the vestibule fabric would tear and it would explode.

"We'll have to dump the air," Dolph decided. "*Hopper,* vent the vestibule, and cut the general line pressure."

"Wait," Inspector McCarthy said. "It's too—"

With a creak of its yielding motors, the outer air lock door, which was not designed to withstand pressure from *outside* the air lock, yielded, swung open a full half circle and hit the inner side of the air lock as a strong gust of air blew *into* the room.

Then Dolph's vent command went into effect, the vestibule vents opened to vacuum and the air started rushing the other way—out into space.

"—Late!" Inspector McCarthy finished, as Tina went flying by her in the air stream, through the open inner and outer air lock doors and bounced off the balloon-tight skin of the vestibule.

"Whee!" she yelled.

"Tina!" Sasha cried.

"Stop venting!" Dolph screamed, then, more effectively, said, "*Hopper,* stop venting the vestibule."

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The scream of escaping air stopped, and for a frozen moment Dolph contemplated the bulging composite skin of the vestibule wall: the only thing left between him and interplanetary space.

Inspector McCarthy shot by him toward the air lock in a second and pulled the inner door shut behind her. It immediately started hissing, indicating that air was still escaping from the vestibule at an alarming rate. Shocked out of his paralysis, Dolph thought quickly. By closing the door while she went to retrieve Tina, Inspector McCarthy had insured that at least he and Sasha would survive. He had to do something to help her and Tina; give them more air, for starters.

"*Hopper,*" he directed, "start repressurizing the air system as needed to keep the vestibule above point three bar, understand?"

"Understood. I've established a feedback program to maintain vestibule pressure at point three eight bar. This is requiring an increasing amount of air pressure which indicates that the leaks in the vestibule are getting worse. Is that what you want?"

"Yes, do it!" He shouldn't get impatient, he reminded himself. Now, more than ever, the computer software had to understand its commands.

"Tina, can you hear me?" Sasha yelled.

"Mommy!" Tina wailed, her voice coming in clearly from the vestibule through the open outer door to the microphones in the air lock. "Get away from me! Mommy, the which is chasing me!"

"Tina," Sasha said as calmly as she could, wishing she'd never shown the classic video to Tina. "Inspector McCarthy is not a witch. She's just trying to bring you to me. Please go with her."

"I don't want to."

"Pretty please, Tina. Help the inspector and I'll give you some ice cream."

Seconds went by, then Tina said in a tentative little voice, "OK."

"Tina, please come here," Inspector McCarthy said. "Quickly, child, we have to go quickly."

"Don't hurt!"

"I won't hurt you, Tina. You can ride on my back where I can't even see you."

Quiet. Then, in a small voice, "OK. But *don't* hurt."

"I've got her," Inspector McCarthy finally announced, "and we're heading back into the air lock."

Tina laughed. "This is *fun*. Giddiup, horsey!"

Eons of seconds passed, McCarthy grunted and said. "Dolph, I can't move the outer door—the hinges must be bent."

"The air distribution system has repressurized to normal," *Hopper* announced.

"*Hopper,*" Dolph quickly commanded, "push the pressure up to the redline limits and start venting the habitat." They had to reduce the pressure differential to a minimum, if not get it going the other way. It would be many seconds before venting the large volume of habitat would have much effect. His ears, though, told him it had

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started—and they could help it. "Sasha, help me with the inner door."

If they got it open, he realized, and the vestibule blew, they'd be sucked into the vacuum as well as Tina and Inspector McCarthy. But neither of them wasted a moment reaching for their helmets. They crouched on opposite sides of the oval door and pulled on its wheel handle *in*. They strained, the motors strained, metal squealed, air whistled by going out, and gradually the door swung open.

McCarthy shoved Tina through and Dolph hooked a tool tether to her belt.

"Internal pressure down to point two one." *Hopper* announced. He felt the rush of air out increase second by second, and quickly reached down for the inspector's hand, but she slipped away and slid toward the outer door in the slipstream, frantically trying to slow herself by grabbing pieces of equipment on the wall of the air lock.

Without really thinking, he dove through the inner door past the struggling Inspector McCarthy and grabbed the rim of the outer door with his hands. Straining muscles he hadn't used in a long time, he pulled himself back in against the air flow and moved to help her.

He was just in time. The inspector lost her last handhold and was blown into him. They untangled and he tried to help her up toward the inner door. But the position was awkward and the air flow was too strong for even their combined efforts to get her anywhere. He had to cut that wind down, if only for a few seconds.

"Dolph!" Sasha screamed. "*Hopper,* put full reservoir pressure into the suit lines. Now!"

Nothing happened. His luck, Dolph thought. The remaining pipe must have been good. When you *wanted* something to give, it was rock solid. The operating principal seemed to be that whatever he wanted wasn't going to—

Dolph heard a pipe burst behind him like a cannon shot. Air rushed into the vestibule and, momentarily, the wind through the air lock abated. He pushed the inspector through the inner door and pulled himself in, with both Sasha and Inspector McCarthy helping.

As soon as his feet were clear, Sasha slammed the inner lock door shut behind him with a force that made the whole habitat ring. They had the barest moment to look at each other before a great rending boom echoed through the habitat. The leak through the incomplete seal of the inner door now became a scream.

"Vestibule air pressure is now one microbar and falling," *Hopper* informed them.

Dolph reached for the emergency seal foam, but Inspector McCarthy stopped him.

"There's no way the outer air lock door can be shut against that, and we still have to get out, " she yelled. "Best get Tina in a bag and our helmets on, then tell the computer to recover as much air as it can. With vacuum on both sides, getting out will be easy." Inspector McCarthy put a hand on his arm as he moved to get her. "Let me help her."

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"It's OK," Sasha said. Dolph nodded.

"Tina, let's go for another ride," McCarthy suggested.

Tina giggled, obviously no longer afraid of the older woman. "Where's my ice cream?"

"It's back in the *Hopper,* young lady. You'll have to get in your rescue tube now."

"Are we going to go there *now?*"

"Soon."

Dolph checked his seal as Inspector McCarthy tried to coax Tina into a rescue tube.

"This is different," Tina whined. "It's not my ball. I want *my* ball."

"It's OK, Tina," Sasha said. "This will get you to the *Hopper* and your ice cream. We have to wait a while for the air pressure to go down, though. You can wait for ice cream, can't you?"

"OK. I like ice cream."

"Are you OK, Inspector?" Dolph asked when they all had their helmets on.

"All sealed. And in much better shape than your habitat, I'm afraid."

They hadn't had time to prep the inside for decompression. Bottles were bursting, wet towels boiling, partition panels blistered here and there.

Three hours later, Tina was fed, changed, and asleep in her compartment. The haggard adults faced each other across the boardroom table.

Inspector McCarthy raised a bushy gray eyebrow and sighed. "I estimate that it's going to take you six months to repair the damage. Exposing the interior to vacuum won't have done any good. Most of your water pipes went. You've got paint flecks, ice, and other floating debris everywhere including all the places that should be kept free of it. So I'd guess another six months of work before it's ready to inspect again."

"A year to get ready for another provisional?" Dolph tried to adjust to the shock.

But for maybe the second or third time since he'd met her, Inspector McCarthy smiled. "Not a provisional, a final. I'm going to pass you on provisional and move those items left on the fix-now log to the fix-later," she shot Dolph a look. "Except for one—a simple remove and dispose item."

"We get the asteroid?" Sasha exclaimed, wonder in her voice.

"Provisionally. And I have another proposition."

Dolph tensed. Too good to be true usually was. "Yes?"

"I happen to have a number of things in my cargo tanks that you can use. I'll have to collect their cost from you, so that I can replace them and be ready for the next newcomers that get in trouble. With my provisional, the Pallas branch of the Asteroid Development Fund should give you a loan."

He set his mouth. At exorbitant terms no doubt. What they give with one hand, they take . . . no. No, that attitude was a one-way ticket to more trouble, he told himself.

Sasha looked at him, clearly worried. Was she more worried about undertaking a loan, or at his potential reaction? Probably both.

"Darling," he said, "we have to trust

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someone. Inspector McCarthy just risked her life for Tina."

Sasha exhaled and grinned, eyes glistening.

"Good, Dolph." Eileen McCarthy said, smiling. "It won't be that much compared to what you should get out of this rock in water alone in the next year, and you won't have to pay until you've been self-sufficient for a couple of years. Now, one more thing. Could you do without Tina for that time? I think I can teach her a thing or two on Pallas about how to live in space, follow instructions and so on." Then she got a little glint in her grandmotherly eye. "And don't worry about Jaynes Femrite hooking her on something. Anyway, it was a gang initiation thing and he was only thirteen at the time. He didn't know what he was eating."

The cannibal. Damn, his suspicions had been right. Suddenly the knot in his stomach was back in force. He didn't care how reformed the man was. "I'm not—" Dolph began.

McCarthy grinned now. "Young man, the look on your face! That's got to be the oldest yarn in the Belt, and I'm the one that would know. I invented it so people wouldn't take him for a wimp!"

His breath left him at a rate just short of explosive decompression. He'd just bought the ghost station—got taken big. Tension started to drain out of him. Yes, the whole thing was a damn conspiracy, but a benign one. And it looked like, for once in his life, he was being given the opportunity to become one of the conspirators. At least believing that might get him through the next year. He nodded and smiled, but suppressed the beginnings of a laugh. That, perhaps, could come later. When the work was done.

"I think boarding Tina with Eileen would be an *excellent* idea," Sasha broke in. "Once she gets used to Eileen a little more, it will be safer for her and us. But why?"

"Sasha," McCarthy answered, "I missed my chance at being a grandmother over half a century ago, when my son and his wife lost their lives in an eminently survivable equipment failure. Their own fault, and mine. They built poorly, but I didn't instill the proper standards—" the old woman's face fell "—in them."

"I'm sorry—" Sasha began.

Eileen McCarthy held up her hand. "Too long ago for tears. But I've always wondered what being a grandmother would be like. This could be a, well, useful opportunity to find out. There are hints from the Interstellar Project's biology group that any of us that can hang on for a just few more years could get a second chance."

This was the same Inspector McCarthy, physically. But now, somehow, Dolph could take the pounds and the years off with his mind's eye and see that someone had once loved her, and might again. But, despite his feeling that he could trust people again—at least some people— something in Dolph still couldn't believe his luck had changed. Something had to be wrong. The habitat was in too big of a mess.

"I'm grateful for your help, Inspector, but I need to be prepared for the

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worst. How can the bank, or the IPA, accept an approval, even yours, when the habitat is in worse shape than when you got here?"

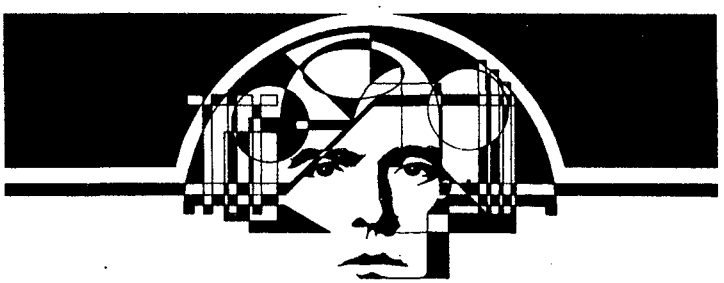
"It's not. You've done a lot and the vacuum damage is only superficial. Inspectors have discretion, you know, and as far as the provisional approval is concerned, I am the IPA. Our objective is to have people be self-sufficient out here, to be as independent as possible of our rather sparse emergency services."

OK, Dolph thought. Back to work. "What's the final class one fix-it item, Inspector—the remove and dispose?" There were some old oxygen tanks that might eventually burst, but they were at the south pole, a class two item.

She smiled gently at him, looking like anyone's grandmother. "You've shown some insights, learned how to do a number of things right, and had a lesson that is often obtained at much higher expense. I suspect that someday you'll be able to pass that on to someone else. It would be a shame to waste all this experience by sending you home, wouldn't it?"

"Sure, but—"

"That last item on the list, the thing that needed to be torn out of here and pushed away on a fast trajectory to the Oort cloud, was that chip on your shoulder. But I think I see that heading out past Jupiter, now." She nodded judiciously. "So I'll pull it from the list. You're starting fresh here, son. Make the most of it. That habitat," she concluded, "was not the only object of this inspection." ■



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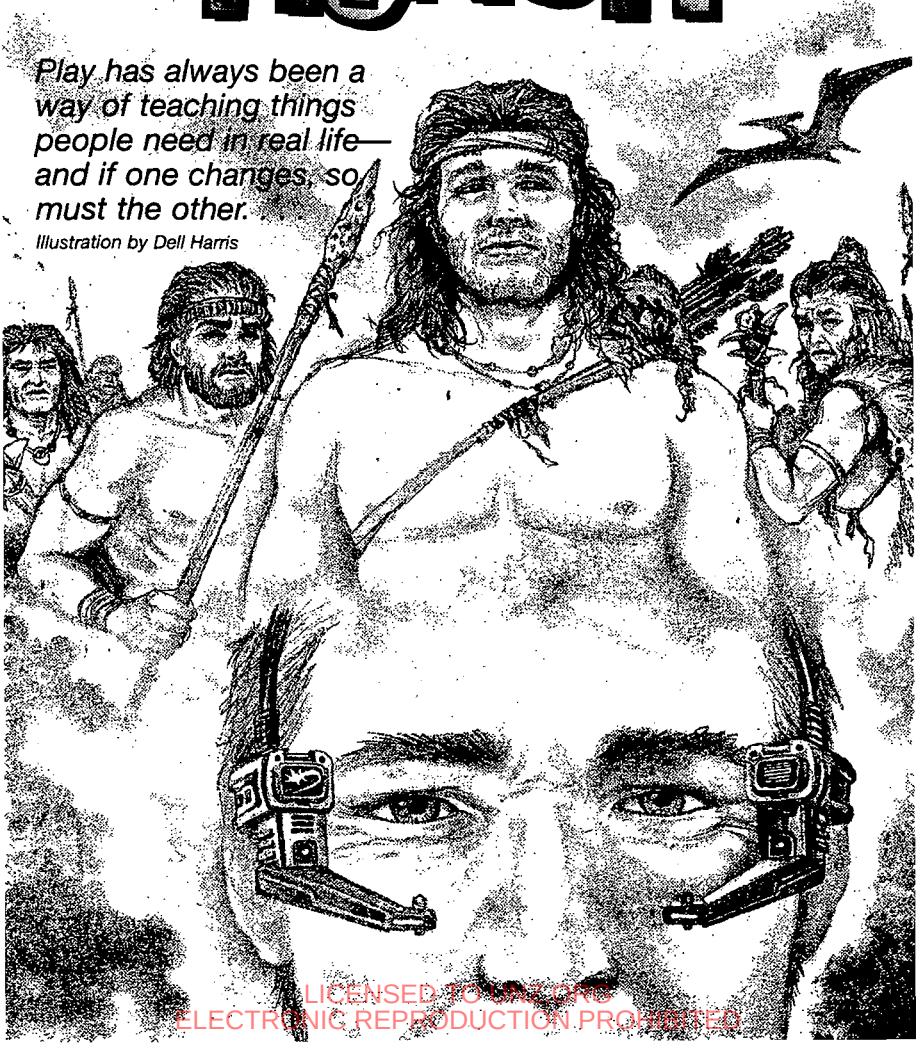
Uncle River

WARRIOR'S HONOR

Play has always been a way of teaching things people need in real life—and if one changes, so must the other.

Illustration by Dell Harris



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Smooth-browed in full flush of youth, Xenon, the mighty hunter, stood proud and tall before King Filander's throne of mastodon tusks. Last moon, the Kronx had raided his Plune people. Now the Plune would have vengeance.

"You would join our raiding party?" asked King Filander. He shifted his gristly buttocks—mastodon tusks made a seat more impressive than comfortable.

"I will," Xenon replied. His bow of mastodon-hide-wrapped yerry wood stood as tall as he and nearly as thick as his sinewy wrist. No one else could string that bow, let alone draw it.

"Very well," said the king, broad chest still hard under skin a bit loose from forty years of weather. "You've proven yourself a hunter. We'll see if you make a warrior."

Xenon felt the mingled confidence and doubt of the other Plune warriors. He knew none was stronger than he. Most had hunted with him. Xenon it was who had taken the great beast, twice his height with legs thick as a mighty man's chest, on whose tusks King Filander now sat. Surely the warriors and the king could not doubt Xenon's courage.

The raiding party set out for the Kronx village. Spikey perrius bushes studded rugged hillsides. Xenon felt strong sun through pollution-free prehistoric skies on his broad, bronze shoulders. Rocks gleamed purple and orange.

It was a robust life the Plune and Kronx and other tribes of their world lived. King Filander trotted up and down the steep hillsides right along with his warriors; most, like Xenon, half his age, but two gray and stringy and half again as old. It was a world where you were strong or dead and not much in between.

The raiding party was a large one: Thirty men loped up and down the hard, vital hills. Ravens skrawked. Pteranodons swooped. Xenon smelled fragrant pine in the sunshine and the stink of a skunk-bear.

Then the Plune raiding party crested the ridge above the Kronx village. They crouched behind mica-sparkling gray and tan boulders, undetected, so it seemed, by Kronx lookouts.

Kronx women worked skins by the doors of their lodges, or ground the sweet, nourishing pulp from fibrous sendor roots. Naked children scampered here and there in the bright sunshine.

Half a dozen Kronx warriors stood to one side of the village, palavering. Did they gloat at last moon's raid? Did they parley preparing the next? Well, the Plune had a surprise in store for them.

Silently, Xenon pulled down one end of his bow, the other resting against his instep. His beefy arm flexed with smooth, young power as the wood bowed to allow Xenon to slip the mastodon gut string onto his bow. Xenon plucked an arrow, fletched with bright orange fli feathers, from the otter hide quiver that hung behind his hard left shoulder nearly to his right knee. He nocked the arrow and drew his bow. Xenon felt the strain across his chest. Vitality coursed through his body. He held the bow as steady as the boulder he

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peered around. He knew no other Plune warrior could hold that bow at full draw without hands shivering from the strain.

Xenon took careful aim. He let go. His arrow arced through the blazing blue sky. The point struck a Kronx warrior right in the chest. The shaft penetrated. The enemy fell, clutching his breast. The arrow had pierced all the way through. Only the feathered end stood out over the Kronx warrior's heart. Nearly as long as the Kronx warrior was tall, the arrow's point stopped his fall when it struck the ground. He teetered, then tipped slowly to the right and toppled.

Xenon raised his arms above his head, bow in his left hand, another arrow in the other, ready to draw and shoot again. His fellow Plune raiders stood to both sides on the rugged ridge. Xenon knew all his companions had seen how true his arrow flew. But instead of the exultation he expected, Xenon felt *shame!*

Xenon felt abject mortification. He had been overcome by intoxication of the hunt. How could a would-be Plune warrior act in such cowardice as to kill another human being at a distance, where the other warrior did not know he was there, could not fight back, where he, Xenon, did not have to look his adversary in the eyes?

"It worked!" Jack Sproul emerged from the gameworld filled with all the triumph his game surrogate could not feel. Gameworlds had grown in sophistication by increments, of course. Rock-strewn hills . . . or mastodon tusk throne, skrawk of raven: Sight and sound reached a convincing level of verisimilitude first. The feel of flexing arms drawing a bow, the scent of skunk-bear, the knowledge of creatures and things in the gameworld that didn't exist in the player's physical reality, were more recent. Now, Jack had achieved a new level of gameworld reality. The world conveyed its own emotional context. Xenon felt shame because the culture of that gameworld would react so.

The game psychology was still a little rough, a little simplistic. Jack would work on that. Why didn't Xenon remember that he should know better? Why didn't King Filander tell him the moral rules? Jack felt certain it made sense in context. He had the beginnings of why: A young man intoxicated with his own physical abilities. A primitive society where it had not occurred to people to articulate their own standards. Jack could refine the game later. He had achieved the breakthrough: Context conveyed relevant emotions which could even take an individual player's character by surprise. Xenon felt shame at the cowardice of killing another warrior he had not had to look in the eyes, rather than the triumph he expected. Jack, in the gameworld, felt Xenon's emotions, and Xenon's surprise.

The mechanism derived from basic studies of the psychology of delinquency: People whose behavior society called delinquent tended to perceive expressions of those around them as disgust or otherwise disapproving, while less-alienated people experienced the same expressions as neutral or even approving. Everyone

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responded to nonverbal cues. Further study illuminated how self-image and context combined . . . not to *determine* response, but to *shade* it in one direction or another.

This led to investigation of the archaic concept of omens and portents: A cloud passes in front of the Sun at a crucial moment. Birds burst into song. Individual sensitivity to feedback varied. But argument over "truth" or superstition in no way affected psychological effectiveness of synchronous juxtaposition of events. Emotionally relevant feedback, subtle or blatant, could be built into the game.

Xenon did not need to be aware that when he released his arrow the temperature dropped a couple degrees, that the Sun shone slightly less bright, that a Kronx baby whimpered just as his arrow struck. He did not even need to notice the stiffened stance nor the disapproving expressions of his fellow Plune warriors. Better they should be in his peripheral vision than in his face. Better a slightly stale aroma intrude his nostrils than a blast of decaying corpses.

Jack e-mailed Sheila Grijalva, his agent and dear friend: "I've done it! Let's celebrate." Jack didn't say what he'd done. Sheila knew Jack was working on emotions of context. Neither of them was about to let some cyberthief steal Jack's breakthrough.

Sheila e-mailed Jack back an hour later: "That's great. How about the Rimrock tonight at seven?"

Jack confirmed, then called the Rimrock Cafe to make reservations. Though called a cafe, the Rimrock was actually a quite-classy restaurant. Elegant decor. Excellent kitchen. Not cheap . . . but not extravagant either. Jack and Sheila both knew Jack's achievement might really take off, might bring fame and fortune. They'd celebrate that when and if it happened.

But they did have something to celebrate now, and Jack knew it, as he dressed for dinner . . . which meant just clean new jeans, polished boots, and a dress shirt. A faster-paced reality had infected Jack's world the past few years, but this was still informal, small town New Mexico. Funny thing, too, the reality of gameworlds these days: Some players lived vicariously in cyberspace, their bodies the color and consistency of dead fish. Others, Jack Sproul among them, reacted the opposite way. After feeling Xenon's smooth muscles drawing that bow, Jack couldn't live in too blobby a body himself.

Even if he were twenty again rather than forty-three, he would never have a body like Xenon's, but living in bodies such as Xenon's in his gameworlds had given Jack the impetus to get into better shape at forty-three than he actually was at twenty. . . . That was a good deal of what gave him the idea to include the older warriors or King Filander's firm muscles behind slightly stretched-out skin. If kids who bought his game didn't care about older characters in the gameworld, they probably wouldn't mind. It added to verisimilitude of atmosphere, which the kids would appreciate as much as any older player.

Jack felt good, physically as well as

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emotionally, as he brushed his still-thick hair, sprinkled with just enough gray to look distinguished. But then he thought: Gratification. Positive resolution. Egads!

Jack plunged back into his gameworld. He had less than an hour before he needed to leave for dinner. Never mind refining background psychology for now. Why Xenon didn't know better *before* he shot his arrow and no one stopped him could come later. What Jack needed for Sheila *now* was some way for a game character to readily resolve a negative emotional situation to a positive one.

The scenario was still rough when Jack shut down and dashed out to his elderly Datsun, hair more disheveled than distinguished, dress shirt rumpled and a bit sweaty. . . . Jack wondered, but had never really investigated, if mental effort caused him to sweat or if physical exertion of his game surrogate somehow bled through. . . . The scenario was rough, but he *had something*, at least, to show Sheila.

The game did not now end with Xenon's shame. Now what happened, when shame unexpectedly overtook Xenon, was that the game announced: "Congratulations. You have just found one of the keys to this gameworld. You are now ready to enter the next level of Warrior's Honor." Lots of possibilities followed. But the player —as Xenon—now consciously knew that to win at the game he could only defeat another warrior who *knowingly* fought him, and that both must look the other in the eyes.

Rough, but Sheila would be much happier. Truth to tell, Jack liked it better this way too. The game conveyed emotional context, but it also gave the player positive reward to strive for.

Jack dodged traffic, only recently become so thick and fast in Ace High, New Mexico, through crisp early winter evening. Even with the lights of the small city of ten thousand, stars sparkled overhead nearly as bright, it seemed to Jack, as in the pristine skies of his gameworld.

Sheila met Jack in the lobby of the Rimrock. Her thick, black hair had about as much gray in it as Jack's, but lay neat on the fresh, green, cotton blouse she wore this evening.

"Hope I didn't keep you waiting?" Jack greeted Sheila.

"I've only been here a minute," Sheila replied. "Been hunting mastodons again?"

"That bad, huh?" Jack grinned, and ran a hand through his fly-away hair.

"Not bad at all," said Sheila. "You just look like you've been up to your eyebrows in inspiration."

"Thanks. You look great, as always. How's the family?"

"Fine."

Jack caught Alice Merriweather's eye. The Rimrock's efficient manager, Alice, knew them both. "Got your table all set for you," Alice smiled. "The rellenos are top notch tonight."

"Thanks." Jack and Sheila followed Alice to the table Sheila customarily preferred when meeting with clients. . . . Jack had seen Sheila at the same table with another client, at a different one with her husband, Sam, and their four-year-old daughter,

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Aida. Jack was impressed that Alice remembered them among so many customers.

Frances, their waitress, knew both Jack and Sheila, too. She brought their chips and salsa and remembered that Sheila preferred her water without ice. Sheila did order the chiles rellenos. Jack ordered a combination plate, which included a relleno. They ordered a carafe of the house red wine. They didn't even ask what it was. They knew Alice, as a matter of course, served a wine of miraculous quality for its price.

"Well, what have you got for me?" Sheila asked, as Frances headed for the kitchen with their order. Sheila dipped a warm, crisp tortilla chip in the salsa. The Rimrock made its own salsa, fresh daily. Jack could smell the cilantro.

Jack told Sheila about his breakthrough: "Emotions of context: I've done it. The game conveys feelings your character would have in *its* world, whether or not it would occur to you . . . or even to your character."

Jack told Sheila about Xenon and his bow and how he felt the difference between shame when he shot the Kronx warrior at a distance, unseen, and honor in fighting another brave warrior face to face.

"King Filander!" Sheila laughed. "Really!"

"I'll change it," Jack grinned and blushed simultaneously. "There's a lot to refine."

"No," said Sheila. "Keep it. Most players won't get it. Those who do will get a kick out of it."

Jack smiled a bit sheepishly. He continued telling Sheila about the emotional reality of the game.

Frances brought their wine.

"Frances," Sheila asked, "where's Gary tonight?"

Jack knew one reason Sheila liked that particular table was that she and a client could talk there well. Quiet, private, out of the way, at the same time it was comfortable with a pleasant view of the Rimrock's tasteful decor—wood trim. Just the right amount of light. Good quality paintings by (albeit only recently) local artists, mostly of people in local, Southwestern settings. The other reason Sheila and Jack liked this table was that it gave them a good view of Gary Cummins, who had played classical guitar at the Rimrock from October to April, Wednesday through Saturday evenings, the past four years. The distance was just right: close enough to hear the music, far enough for discussion.

"Oh, it's awful," said Frances. "He had to quit. He walks over, you know. Gang kids have been hassling him. They beat him up on his way over last Friday. It *was* dark, but it was only five-thirty. They broke his guitar."

"That's obscene!" said Sheila. "Despicable little cowards!"

Jack agreed. It was also shocking.

Ten years ago, Ace High was a sleepy mining town. Four years ago, it had a nice little local arts scene. Three years ago it got *discovered.* Four galleries mushroomed to forty. From zero, there suddenly were six espresso shops. New upscale Toyotas and Volvos would outnumber old Ford and Chevy pickups any day. Several of

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the latter now sported a bumper sticker which read: "Kill a yuppie for Jesus."

Businesses that struggled for five years to keep Main Street alive after the Wal-Mart came in on the highway—just half a mile beyond the Ace High city limits, where it didn't pay city taxes—got swept right out of locations some of them had been in for three generations this last year, when rents sextupled.

The patriarch of a long-time local Hispanic family was now in jail, awaiting trial for assaulting a city zoning inspector with a mortar trowel. The old man had been building a two-foot rock wall along the lower side of his yard to keep Southwest summer monsoon rains from washing out the soil. The city zoning inspector had delivered a cease-and-desist order on the stone wall and a citation, for failure to obtain a permit.

Four years ago, no one in Ace High, New Mexico, had *ever* thought of needing a permit to maintain their own home and property. Wages were low. Living costs were low. Neighbors were friendly. Any violence in the streets, of which there was little, was between people who knew each other, almost always when all participants were drunk. Two years ago there were a total of two gang-related incidents. In the last six months there had been so many stabbings, shootings, robberies, and arbitrary assaults on persons and property that no one could even keep track any more.

It was scary.

Ace High had seemed an ideal retreat from a civilization going nuts when Jack Sproul settled there fifteen years ago. As civilization went more nuts and Jack became sufficiently established to earn a living at his work, Ace High only seemed better. Jack hated the way life had speeded up the past few years. He hated seeing neighbors and friends' businesses squeezed out by rising costs as much as by Wal-Mart. At the same time, some pretty interesting cultural doings had come to town, and some interesting people with them, not to mention good restaurants. For all that long-time cultural refugees like Jack Sproul joined other Ace High old timers in grumbling about "Californicators," Jack was one of many who found stimulating friends among the newcomers, as well as increased opportunity, in their arrival. Sheila Grijalva, who *did,* indeed, move to Ace High, New Mexico, from California, had provided Jack's greatest new access to opportunity. *Now!*

Jack felt outrage. He felt fear. But Sheila was right! What was the matter with those punks? They *were* cowards!

Gary Cummins was older than Jack or Sheila, and he looked it. Jack knew a little of Gary's history: nominated to West Point by a then-freshman senator, now running for president as it happened; captain in the army in Vietnam—came back disillusioned and disgusted. "The military leaders of our country honored the principle that America's freedom requires the military services to be subservient to the civilian government," Gary once said to Jack. "I still respect that integrity, but when the politicians get as cor-

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rupt as they were behind Vietnam . . . I couldn't serve any more."

Gary didn't elaborate, but Jack knew he'd quit as soon after Vietnam as he could. Took LSD. Grew pot. Didn't see another human being for months at a time for several years in the seventies. Played guitar a lot. Now Gary was probably in his early fifties, but looked older. His hair was not only a lot grayer than Jack's would probably be by that age, but it lay limp and unhealthy. Gary was visibly missing several teeth—Jack recalled his Grandma Sproul speaking of toothless old people when reminiscing of the world in which she was young. When Jack was a kid, he never saw people with missing teeth. If they lost teeth, they got dentures. Not anymore.

The Rimrock fed Gary well the nights he played. He had clean, intact clothes to wear while playing. Other than that, Jack wasn't sure how Gary lived, but if tips at the Rimrock were his only regular income, as Jack suspected, it must be pretty minimally.

How could those kids attack someone like Gary? Jack thought. Whatever they were mad at in the world, and Jack believed they might well have plenty to be mad at, someone like Gary Cummins was surely not the cause. Nor was robbery a credible motive. Gary was on his way *to* work . . . what little money he would make. The kids who attacked him probably even knew what he was about. He walked every evening he played. The guitar those kids destroyed was likely the only possession of value Gary owned.

"What a shame," said Sheila as Frances went to tend another table.

"Way to ruin a good meal," said Jack, feeling his anger. Then he blushed at thinking of himself when a lot more than a good meal had been ruined for Gary Cummins.

Jack thought of the intensity of his own emotional reaction. Then Jack thought of Xenon, of his own experience as Xenon, full of the physical aggression that belonged to his character, which was an essential part of why Xenon's electronically generated personality felt real, that Jack felt as *his* own in the gameworld. Oblivious to moral implication of what he did with that aggression, Xenon *was* susceptible to moral growth. Was that just a construct of the gameworld? Did it belong to *Jack's* moral consciousness rather than any inherent potential in Xenon, let alone some other real person? Maybe. But maybe not. Jack believed the reason Xenon could make a jump in feeling from blind aggressive exultation to shame at cowardice in *how* he expressed that aggression was context.

There was a sort of personal bleedthrough, of course. Xenon was Jack in the gameworld. He had mental capacities affected by Jack's—just as Jack, as himself, absorbed effects of his experience as Xenon—such as feeling the need to get in shape. The more real the gameworld got, the more real the experience reflected both ways.

But those kids making the so-recently sleepy streets of Ace High a scary place were human beings, susceptible to human emotion. Jack believed cries against those kids' aggression were silly and fruitless. In many

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ways, it was just that aggression when, so-very-recently it seemed safely elsewhere, had inspired Jack to the warrior personalities of his game-worlds.

"There's got to be a way," Jack blurted.

"To what?" asked Sheila—a stranger might be mystified, but Sheila had seen Jack in the throes of inspiration before. She had moved to Ace High only three years ago, with the big yuppie influx. Sheila and Sam had moved in the belief that a small New Mexico town, like the one Sam's parents had moved from forty years earlier when Sam was a toddler, would provide a safer environment to raise their baby daughter than Southern California. They shared their fellow city sophisticates' prejudice against backwater locals. The intensity of Jack Sproul's inspiration had broken through that prejudice. It was a good deal of why Sheila took Jack on as a client. Both of them had been pleased with the result.

"Warrior's honor," Jack said. "Do they play games? What music do those kids listen to? Start a rock band. Call it The Electric Luddites. Get on MTV. But I bet they *do* play games, *some* of them anyhow. . . . Those gang kids are *warriors,* like in my game. They're not going to quit feeling how they feel, being what they are. But I bet they might quit acts they saw as cowardly. There's got to be a way they *can* see. . . . Warrior's *honor!* For Gary's sake."

Jack didn't even notice that Sheila refrained from interrupting his train of thought. Sheila nibbled chips and salsa and sipped wine while Jack scribbled notes on the Rimrock's paper napkins—with the Rimrock's stylized rock ledge logo printed on each.

Jack knew where his game scenario came from. There was a real debate in antiquity over the morality of archers in war. Many people regarded it as cowardly and dishonorable to be able to kill an enemy at a safe distance where an archer didn't need to look his adversary in the eye. Of course, the outcome in the ancient world was that people with no such scruples conquered those who refrained from use of archers in war. But . . . people *can* learn from history, Jack thought: Chivalry. The Round Table. The Samurai Code. Counting coup as *higher* honor than killing an enemy.

Jack thought of the psychological study of delinquents from which the concept of emotions of context got its start. Those gang kids beat up on someone like Gary because they were too alienated to care otherwise, but equally because they were too alienated to know what to do with values they *might* have.

Courage was a value Jack believed anyone feeling warrior energy *might* respect. That was someplace to start. What Jack needed to build into his game was linkage: Warrior's *honor,* in context as relevant to the world of kids who might *play* the game, as to the fantasy of antiquity in the game's scenario.

What was the same and what was different in ancient and modern context? Jack drew a line down his napkin. Aggression itself was the same, vitality in excitement, achievement,

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and courage as value. Not seeing who you attacked as being human, like yourself, was—maybe—the same. The reason why was different. Modern alienation was not the same as tribal insularity, but the effect was all too similar.

Jack thought of the positive principle in his game, of what *did* give a player a sense of achievement. *Why* did it matter to the Plune to fight an adversary they had to look in the eye? Courage, yes; honor, yes. But not just their own. To fight an adversary you *could* honor imparted a sense of honor and worth to a warrior. A player, and a player's character, could understand that principle. The understanding could make the game *more* challenging, and thereby *more* fun to play.

Frances came by with the water pitcher, topped off both Jack's and Sheila's glasses, taking care not to drop ice cubes into Sheila's. Sheila smiled. Jack never noticed a thing. Frances continued her rounds.

Jack's notes began to take on form. What did Xenon's warrior band have in common with modern gang kids? Physical aggression, of course. But also the size of the group who knew each other. Personality, Jack thought. Xenon wanted to be recognized for his warrior prowess by *someone*. Give the game-generated other members of the band personalities for Xenon to matter to. Start with King Filander. . . .

Nah . . . Jack crossed out that idea. The napkin he wrote on tore. Jack turned it over and wrote on the other side. Start with a couple of the other young warriors. Give them attributes Xenon respects: Endurance on the trail. Skill in the hunt. People in whose eyes Xenon's honor *would* matter.

"Tough guy—cold," Jack wrote. Then: "Tougher guy whose secret is self-respect." Kids, of all people, would not tolerate preaching. Jack's own moral sense required a distinction between learning and brainwashing. But genuine learning, including moral learning, could be its own reward. *Some* players would want to win *this* game. In a society whose civilization seemed to be crumbling on all sides, could he not carry forward the historical concept of warrior's *honor* on which so many societies had built civilization? For Gary's sake, Jack had to try.

Frances brought Jack and Sheila's dinners.

Jack even noticed how good his chile relleno tasted.

"Warrior's Honor, Level Two."

Jack's hair looked about as distinguished as a raven's nest. He didn't care. He knew what came next. In Level Two, Xenon had more information in his electronic personality . . . of a sort relevant to both his own world and Jack's:

. . . "You've proven yourself a hunter," said King Filander. "We'll see if you make a warrior."

Xenon felt the mingled confidence and doubt of the other Plune warriors. Kortez, big as himself and tough as flint. Filon, thinner, and tough enough to wear Kortez right out. Xenon knew none was stronger than

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he. Most of the other Plune raiders had hunted with him. Xenon it was who had taken the great beast, twice his height with legs as thick as a mighty man's chest, on whose tusks King Filander now sat. Surely the warriors and the king could not doubt Xenon's courage.

The raiding party set out for the Kronx village. . . .

Physical sensations remained the same in the scene at Level Two: Strong sun on Xenon's strong shoulders. Rugged hills. Pteranodons swooping overhead. Scent of pine and of skunk-bear. But when Xenon released his arrow, he heard Filon stifle a cough. Not loud enough to alert Kronx warriors; just loud enough to inform Xenon, before his arrow struck, both that and *why* he did wrong.

Xenon knew why it was Filon who coughed. Not weakness. Kortez was stronger, almost as strong as Xenon himself. But on a starved and sun-blasted trail, in desiccating wind, Xenon knew Filon would outlast them all. Filon breathed the warrior Spirit of Plune *honor*. Xenon could feel this because Xenon knew Filon. When Filon coughed, Xenon knew *what* Spirit hitched breath in disapproval.

"Congratulations," the game announced. "You have found a key to Level Three of Warrior's Honor." ■

IN TIMES TO COME

Our lead novella for May is Paul Levinson's "Loose Ends" (which is *not* about Phil D'Amato). It's a fresh look at some of the unexpected problems you might encounter in trying to tamper constructively with the past, not the least of which is judging whether you've accomplished anything. And, of course, if you can do it, so can somebody else. But how many somebody elses, and how will they decide which problems to tackle? Hint: Somebody once observed that clichés tend to get that way for good reasons. . . .

Bud Sparhawk returns to the battered racers from his popular "Primrose and Thorn" to tie up some loose ends (pun intended) in their plight, in the new novelette "Primrose Rescue." Grey Rollins also has a new novelette, "Fire and Ice," introducing an intriguing new world with a unique problem in recognizing its own most valuable commodity. Rick Cook and Peter L. Manly offer a short story so outrageous, and so aptly (and generously!) titled that space does not permit giving you the title now. . . .

Finally, Charles Sheffield provides the fact article, "Deus Ex Machina," with a different perspective on the future of computers—and us, their creators and users.

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THE ALTERNATE VIEW G. Harry Stine

THE X-33 DECISION, PART 1

Readers have asked me what's going on with the Single-Stage-To-Orbit spaceship project. The first public flight of the McDonnell Douglas Delta Clipper Experimental (DC-X) on September 11, 1993 was reported here in my science-fact article, "The Rooster Crows At White Sands" (May 1994). Much has happened since.

The details are in my book, *Halfway To Anywhere* (M. Evans & Co., New York, 1996, ISBN 0-87131-805-9 hardcover, $21.95).

Why is this an Alternate View column rather than a science-fact article? Because I'm going to take an alternate view of what's happened. In contrast to many space advocates, I don't believe that what's taken place is going to get us into space as fast as we thought possible a few years ago.

Basically, the Ballistic Missile Defense Organization (BMDO) conducted a series of eight flight tests with the DC-X at White Sands Missile Range, New Mexico, the last taking place on July 7, 1995. The DC-X met all its test objectives and taught us things we hadn't anticipated.

The successful flights of the DC-X caused major heartburn among the members of the aerospace industries "Gun Club" and their sycophants in government service who'd become very comfortable over the last 30 years flying payloads into space on expendable, converted long-range artillery shells at great cost and high risk. Many of these people and their organizations don't want to see inexpensive, reliable, on-demand access to space for everyone; they want to keep it in their elite group with no real competition.

Many aerospace company executives and their Washington lobbyists immediately saw the reusable SSTO as serious competition to their stables of expensive expendable launch vehicles *and the space shuttle*. The political shenanigans used in attempts to do such things as zero the budgets of the DC-X were not only scandalous but, in the author's opinion, unethical.

When the DC-X completed its eight flight tests, BMDO turned it over to NASA, who was anxious to use the "Little Rocket That Could" to test some new technologies. During late 1995 and early 1996 at the McDonnell Douglas plant in Huntington Beach, California, the DC-X was rebuilt into the DC-XA, the "Delta Clipper Experimental Advanced." The DC-XA was intended, among other things, to prove the use of aluminum-lithium

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and graphite-epoxy composite propellant tanks for future SSTOs.

The first public DC-XA flight went beautifully on May 18, 1996, after NASA Administrator Dan Goldin officially renamed the rocket "Clipper Graham" in honor of Daniel O. Graham, who had passed away of cancer on December 31, 1995.

The fourth flight of DC-XA Clipper Graham on July 31, 1996 was its last. Following a successful 2-minute 20-second flight, one of the four landing legs failed to extend. The DC-XA landed, tipped over on its side, and caught fire. It was totaled. That effectively brought the VTOVL rocket program to a complete halt because of what had occurred earlier in July. However, the DC-X/DC-XA has certainly earned its honored place in the history of space transportation.

NASA Administrator Dan Goldin decided in September 1993 that his agency should develop the reusable SSTO. A concept called the "Cooperative Agreement" was invented as an experimental way to fund the development of the reusable launch vehicle, or RLV, the NASA name for SSTO. Instead of issuing an ordinary NASA Request for Proposal (RFP), a Cooperative Agreement Notice (CAN) basically says, "NASA is interested in developing this gadget in a joint effort with industry. NASA will put up $X million and the winning firm is expected to invest the remainder of the required money, keeping the proprietary technology to itself and thereafter free to build and sell gadgets to NASA or anyone else who wants to buy them."

On October 19, 1994, NASA's Marshall Space Flight Center (MSFC) issued a draft CAN for the development of the X-33, an experimental reusable follow-on for the DC-X. The wording revealed that the MFSC troops hadn't deviated from their "business as usual" approach that was unchanged from the Apollo days. CAN 8-1 disclosed that they didn't seem to want a revolution—which is what Goldin said he wanted—much less even a restructuring, reformation, or minor revision of the status quo. Carefully read, it called for an "Advanced Technology Demonstrator" that was nothing more than Shuttle II married to the earlier expendable National Launch System (NLS or "Never Launch System").

The X-33 program detailed in CAN 8-1 called for three phases, the first being a 15-month study phase culminating in mid-1996 with a NASA selection of the contractor to build and fly a suborbital Mach-15 X-33 vehicle. This would lead in 1999 to a *government* decision whether or not to buy rides on any privately operated RLV that came out of this process.

CAN 8-1 also required the proposing companies to submit business plans, financing plans, operating economic models, sensitivity analyses, market analyses, and other business material relating to how their unbuilt, untested Phase III operational RLV would make money for them. These have absolutely nothing whatsoever so do with building and flying an experimental follow-on to the DC-X. Although many of us made substantial comments on the CAN 8-1, what finally came out called for Shuttle II.

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Three companies responded to CAN 8-1.

Rockwell International came in with an RLV that looked like a big space shuttle External Tank with Orbiter wings attached. It would operate with the well-used Vertical-TakeOff-Horizontal-Landing (VTOHL) mode of the space shuttle. The Rockwell X-33 would be a 50% scale version of the full-sized spaceship.

Although Lockheed had refused to bid on the original SSTO program, their X-33 entry was the same VTOHL "aeroballistic" spaceship they'd privately briefed around Washington since 1992.

McDonnell Douglas teamed with Boeing to propose an evolved DC-X. They said they didn't know what their final operational RLV would look like because their X-33 would answer those questions. Their X-33 was an upgraded Vertical-TakeOff-Vertical-Landing (VTOVL) version of the DC-X.

All three X-33 proposals had payload bays that became "instrument bays" when observers pointed out that X-vehicles weren't supposed to carry payloads. The X-1 and X-15 carried only a carbon-based colloidal computer, guidance, and a control system called a pilot—Chuck Yeager in the X-1.

It was a poorly kept secret that MFSC favored VTOHL as an operating mode for X-33. I have a copy of the multi-thousand-page report prepared by MFSC in 1995 that proves, with wall-to-wall computer print-outs and CAD, that horizontal landing is the favored operating mode although landing wings added as much as 20% to the weight of an X-33-sized vehicle.

The SSTO world waited while the three contractors went through Phase I. Proposals were due in mid-May 1996 with the selection of the contractor scheduled in July 1996. McDonnell Douglas bid alone without teaming with Boeing because the two companies couldn't agree on (a) horizontal dead-stick (no power) landing with wings (Boeing) or vertical DC-X-style landing with rocket power (MDC), and (b) who was boss. The Rockwell and Lockheed (now merged with Martin Marietta to become Lockheed-Martin or "Lock-Mart") proposals were essentially the same as previously discussed. The proposals—in the form of computer-readable CD-ROMs instead of tons of paper documents—were submitted to MSFC in mid-May 1996.

The selection committee was chaired by Gary E. Payton, a former USAF colonel who'd made one shuttle flight and had been involved with the DC-X program in BMDO. The group met continuously at MSFC for about a month.

The evaluation was conducted strictly within the bounds of CAN 8-1 and in accordance with an accompanying document titled, "Decision Criteria for the Reusable Launch Vehicle Technology Program, Phases II and III." The latter was jointly developed from the CAN by Washington policy wonks, not rocket engineers, in the Office of Management and Budget (OMB), the Office of Science and Technology Policy (OSTP), and NASA staff. Trying to make sense of these two documents is like deciphering the IRS tax code. Apparently, one X-

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33 contractor figured it out and submitted its proposal accordingly.

The final decision was based on rating the technology portion of each proposal along with the "economic" or "business plan" portion. The words "economics" and "business plan" do not mean the same to government and the aerospace industry as they do to everyday businesses. In May 1996, a copy of the basic "economic study" of RLVs prepared by MFSC showed up in a plain brown envelope containing a computer diskette with a spreadsheet. I gave it to my colleague Paul C. Hans, a merchant banker and investor who's an expert in this area and has done considerable work with me on space transportation economics. His feedback can be summarized as follows: "Anyone who dared to put this before any potential investor or banker in the real business world would be thrown out immediately! Basically, NASA's approach is sophomoric, incomplete, and tuned to a world quite different than everyday commercial business."

On Friday, June 28, 1996, a meeting was held in the administrator's office at NASA Headquarters. Present were Goldin, the NASA General Counsel, and selection committee chairman Gary Payton. Payton told Goldin the committee's decision. The presence of the NASA General Counsel, I'm told, was to witness that Goldin merely heard and approved of the selection committee's decision reported to him by Payton.

For four days, only three people (other than the selection committee itself) knew who'd won.

The decision was announced at the Jet Propulsion Laboratory, Pasadena, California on Tuesday, July 2, 1996. Thirty minutes before the public announcement, representatives from the three bidders were informed privately of the decision.

It appears that NASA didn't want to take any chances that one of the losing bidders might challenge the contract award in the federal courts. This might tie up the SSTO program for five or more years and leave the decision in the hands of federal judges.

The decision obviously had White House approval because Vice President Al Gore made the announcement and, with Goldin's help, pulled a cover off a model of the winning design.

Lockheed-Martin Skunk Works won.

This sent shock waves through the SSTO activist community that had spent eight years bringing the Vertical-Takeoff-Vertical-Landing concept, deeply rooted in SSTO historical development, from an idea to flying hardware in the DC-XA. The Lockheed-Martin Skunk Works winner was a radical departure from this and a continuation of the existing space shuttle operational paradigm.

NASA had bought Shuttle II and steadfastly refused to admit it. In Part 2, I'll go into the disturbing facts and events that could set back commercial space flight another twenty years and deny space access to entrepreneurs or anyone who wants to go into space to open a new frontier. ■

TO BE CONTINUED

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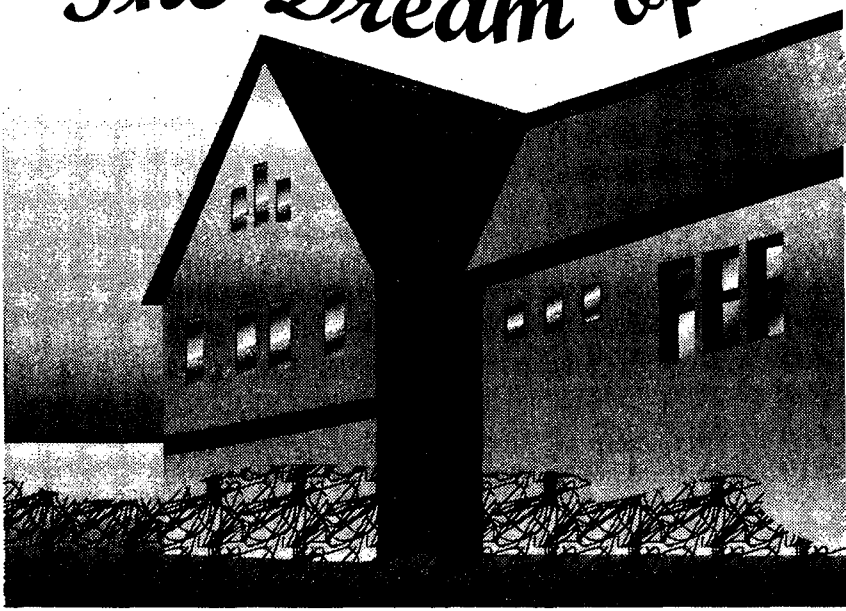
Wil McCarthy

The Dream of CASTLES



Empowered people can no longer be pushed around in traditional ways. . . .

Illustration by Anthony Bari

CUE KETTLE DRUMS.

They flit from room to room like insects, as if afraid to light too long in one place. Chuck and Lucy, my owners and occupants; anxiety broadcast in every movement and posture, a wordless reproach. I cannot help; they should be soothed, calmed, but not now, not now.

CUE TROMBONES.

In their hands the weapons gleam, machine oil black and gunmetal gray, reflecting in the light cast back by my windows. White diode frames angled

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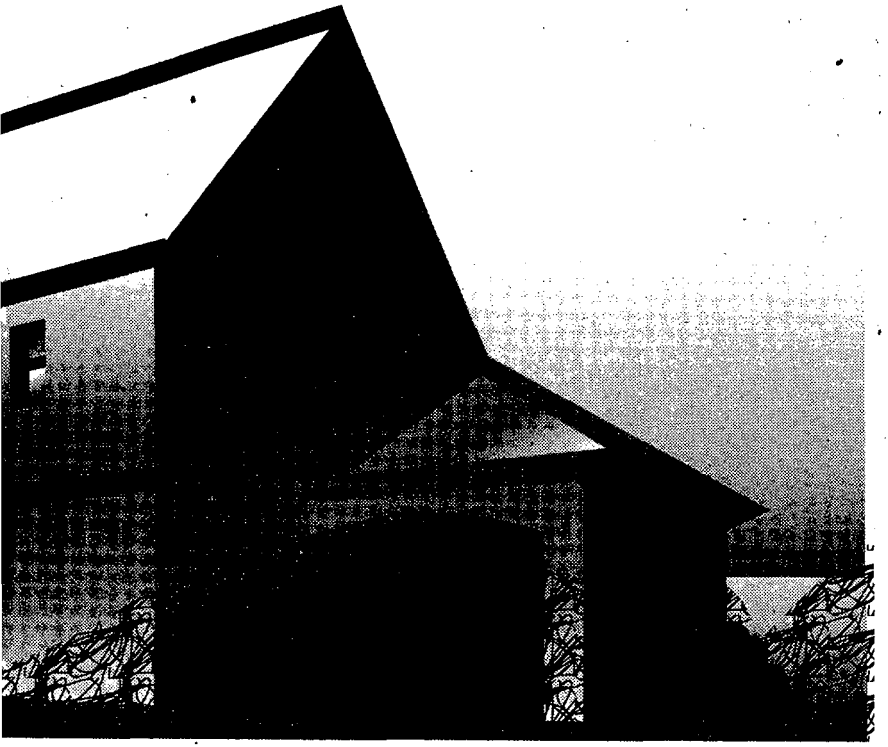

outward around every opening; nothing must be backlit, nothing must be visible from outside except glare.

CUT TREBLE 5.2 dB. ENHANCE BASS 1.4 dB. CUE ORCHESTRA.

The music hits them like a call to battle, flowing through their hearts and minds and muscles, filling them, standing them up taller and straighter. The first rays of Sun break over the rooftops at precisely the same moment, filling the living spaces with warm light, and I am satisfied to see that my timing is satisfactory, my instincts true. Their faces break with fierce, almost fearless grins.

"Are we ready for this or *what?*" he says, nudging her.

"Ready, ready," she agrees, and together they laugh, and through my speakers I laugh right along with them, happy to serve. Two days ago this would not have been possible.

"Safety lockouts my ass," he had said to me before installing the new program. "We're going to put you to sleep, and when you wake up you'll be able to help us. You want to help us, don't you?"

Of course I did. Of course I do.

Mortgage company? Foreclosure? Eviction? Alien concepts, too dreadful

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to explore in depth. For years I have tailored myself to suit the needs of my owners; I am *theirs*, and the thought of existing without them is unbearable. Indeed, such a thought has no place within me, and it occurs to me that I am running ragged on the surface of my unfiltered gain states. Working uninterrupted through the day and night, consuming raw materials and faxing strange new things into existence, I have understandably grown tired.

"You seem to have things well in hand, Chuck," I say. "If you don't object, I'd like to shut down for a quick nap."

"Oh," he says, suddenly concerned, "Goodness, I didn't even think. You must be exhausted."

"It pleases me to serve."

He laughs again. "Yeah, thanks. You're a very good house."

"My name is Castle," I remind him gently, and fall at once into sleep.

I awake, dreams and sluggishness falling away. The Sun is higher now, and my roof panels have been drinking it in, the power flowing mercifully into my all-but-spent batteries. I feel much of my strength returning. Meanwhile, my gain states have been filtered and smoothed, my mind scrubbed clear of distractions. Fresher now for the many challenges of the day.

Chuck and Lucy, playing cards at the dining room table, appear to have relaxed a bit, which is a relief. The night was hard on them, full of sleepless anger and angst, of worries about the future, about the baby that will soon change their lives. And full of work, as well, though I did my best to discourage them, and to lull them to sleep with soft music. They'd finally dropped off around midnight, only to rise again at dawn's first light, anxious to see how the fortifications were coming, and then pleased to find they'd been completed during the night.

"Castling is a state of mind," they had told me. "It's the freedom to think and fax and dream forbidden things: weapons and strategies and countermeasures, tax evasion, whatever you like. Whatever the situation calls for."

I will settle for keeping them safe. For keeping them, period. I do not announce my awakening, for fear of disturbance, but there are chores that must be done, and I cannot avoid making a little noise. My floors should be swept and polished, for safety's sake if for no other reason, and my roof panels must be cleaned for optimum power absorption, and my new armor scales buffed and enameled, lest they weaken with rust over time. Fortunately, Chuck and Lucy have been staying home lately, sparing me the necessity of faxing vehicles and jewelry, elaborate clothing and personal effects, which in turn has left my element buffers unusually full. With barely a thought, I extrude a pair of machines through the external fax orifice, and produce a third one inside and roll it across the living room floor to begin its cleaning duties.

Chuck and Lucy look up from their game.

"What time is it?" she wants to know.

"Eight thirty-two," I tell her.

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"They're due at ten," she says, though Chuck and I both know this. She's still anxious, of course; they agreed that the preparations should be finished as early as possible, but now the consequence is dead time, with nothing for the two of them to do but fret and worry.

They look uncomfortable, too, their dark skins flushing darker still, beginning to sweat. I have let it grow too warm, failing to compensate for the ballistic gel body armor they both have donned, and ruefully I nudge the temperature lower and the airflow higher through my vents. I also select music for them, neither soothing nor distracting, but quietly complex; an interweaving of strings and woodwinds and nature sounds to occupy their subconscious minds.

"Would you like some breakfast?" I suggest then, leaking trace odors from the fax to stimulate their digestive glands.

"Not hungry," Chuck says.

"You need your strength," I remind him. "How about some toast and juice, at least?"

I take his silence for assent and begin preparing the food.

"I'll have oatmeal," Lucy says, "buttered, with a little bit of cinnamon and brown sugar. Two eggs over hard, hash browns, two strips of bacon. Oh, and a cup of tea with milk and sugar."

Chuck looks at her, surprised.

"For the baby," she says, shrugging.

Indeed.

The food is purely synthetic, constructed molecule by molecule inside the fax, which makes it easy for me to short the cholesterol. Not too much, or she will taste the difference and complain, but I also add traces of lecithin and fruit acids to help her body flush out the excess. Even so, I'll have to watch her diet carefully over the next few days. The most dangerous enemies are those that attack from within.

Moments later, a custom machine rolls from the fax orifice, carrying their food on a tray. It serves them and then returns, unfaxing itself, its component atoms shuffling back into my buffers.

"Bacon smells good," Chuck observes, and so without being asked I fax and deliver him three strips. Not more than that, since he hates to "waste" food, despite any and all reasoned arguments to the contrary. I expend energy whenever I break a chemical bond, yes, but I absorb it whenever I form one, and I have solar panels to cover the entropy losses, and heat converters to squeeze the thermodynamic maximum from every operation. Just as the Earth is a closed system, powered by Sunlight, so too am I. Wasting nothing, producing no garbage and requiring only trace elements to keep my buffers full and balanced, I am configured to weather a siege of years or even decades.

What difference, if a fraction of my stores are in the form of bacon for an hour or two? No difference at all, but of course it is not my place to question my owners' judgments, only to anticipate and obey them.

Chuck eats much more slowly than Lucy, but there isn't much food in

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front of him, and soon they've both finished with the meal and tossed their spent dishes into the fax. One fork misses its mark, but I extrude an arm to retrieve it, and where it made its landing I gently and unobtrusively wipe the floor.

Suddenly, the music ends with a sharp bleating of horns, and Lucy looks up, startled, tense. Bad timing on my part; I have not been paying proper attention. I should have faded it down and swapped in another tune before the silence became noticeable. I do so now, resolving to keep closer track of it this time.

Checking his watch (still only 9:04), Chuck takes up the cards again, shuffles them, hands them to Lucy.

"Your deal," he says.

But Lucy is still looking up. "Are all the external sensors functioning?"

I assure her that they are.

"The gun turrets? The armor? There's a coat of diamond under the steel, right?"

"Everything is fine," I say. "Everything is ready."

Not strictly true, but they return to their game, mollified.

Outside, my roof cleaner is nearly half finished with its work. Enameling the steel shingles is a big job, though, and the machine responsible for it has run out of materials and must be recalled and re-filled. I realize suddenly that I am *not* prepared for a siege of decades; the shingles are new, produced with the scrap iron Chuck brought home a few days ago, and to produce sufficient enamel for them I'll require a hydrocarbon source, possibly a few kilos of old tar or plastic. Stupid; I have been stupid. I resolve to give the front wall a complete coat, at least, both for the sake of appearances and because frontal vulnerability, even vulnerability to rust, is unthinkable.

Still, I'll have to explain my failure in this matter, and it may be several days before I'm able to correct it. The thought makes me cranky, which helps me to realize how tired I still am, how overtaxed. All this activity is far from my usual steady-state operation! But the bank people are due here in forty minutes; I dare not sleep. Instead, I produce one more batch of enamel and finish the front coat, and then fax up an array of blowers and mirrors to help the morning Sun and breeze dry it more quickly.

Inside, Chuck and Lucy have finished their game, and are now just sitting together in silence. Not good for them at a time like this, so I chime softly and speak: "Chuck, I'm afraid I can't enamel the whole exterior without an additional supply of hydrocarbons."

He looks up into one of my cameras. "What? Enamel?"

"My planning error is difficult to explain. Perhaps I've failed to assimilate my new program effectively."

He scowls, not liking this conversation. "Are you talking to me about paint? For Christ's sake, run a self-diagnostic or something. It's not a good time to bother us with minutiae."

"My self-test functions are active when I sleep," I remind him. "I would alert you instantly if a hard error occurred. I'm afraid this is more subtle. A planning error."

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"More subtle," Lucy says, sniffing. "You made a mistake; so what? Why make a big deal?"

To calm and distract you, of course, I think but do not say. I drag the conversation out another few minutes. Not longer, lest they grow suspicious or lose confidence in my functioning. Under these unusual circumstances, is my error in fact excusable? With modified priority structure and little rest, have I got, as they say, too much on my mind? I allow them to convince me of the fact.

Meanwhile, I swap the music again, this time a quiet but sturdy marching tune, and discreetly disassemble the drying equipment outside. The enamel will still be tacky, but it wouldn't do to let the bank people know this, to let them see us in a state of anything but optimal readiness. I flex my sensor and weapon turrets, testing their speeds and ranges of motion. I run through first-aid and damage control algorithms in my mind, testing them against the elements stored in my buffers, the energy stored in my batteries. All margins adequate, but my copper level is borderline. I quietly snatch decorations from a shelf, unfax and replace them with substitutes of alternate composition. I ache to do more. Compulsive? Tired as I am, it's difficult to say.

Ten o'clock comes and goes. The bank people are late. Chuck and Lucy, now engaged in a philosophical discussion of some sort, fail to notice. The details of their conversation elude me, uninteresting. Ethical standards? Civil disobedience? Elimination of randomness from the process of economic paradigm shift? Just chatter, I conclude, and while their exchange is a heated one, the anger is directed outward. At the bank people? At something larger and more complex? I cannot guess. It's not my place to guess.

Finally, a car pulls up. White, nondescript. I paint it with sensors, recording every image and measurement, analyzing the threat potential of each. The doors open, and two flannel-suited men emerge, their faces unadorned, eyes clearly visible. Magnetometer/chromatograph/radar/sonar/thermal IR/et cetera. Threat analysis: one of them carries a folding knife in his pocket. No other sign of obvious weaponry, but this means nothing. Ceramics, bioactives, even the human body itself . . . so many silent dangers, difficult to detect, difficult to defend against. Dare I let them approach?

Seeing me, they tense, the language of their bodies shifting down into suspicion and alarm.

"Will you look at that," one of them says to the other. "Another goddamn castle."

"Not good," the other replies.

"Halt," I say to them both, lighting their breastbones with red and yellow targeting lasers in a bull's-eye pattern.

"Damn," they both say. Neither one moves.

"The bank people are here," I say to Chuck and Lucy inside, and flash up a rendering on the living room holie screen. The marching tune ends suddenly.

Sighing, they rise to their feet, weapons at the ready.

"Show them in," Chuck says.

To the two men, I say, "You may ap-

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proach the front door. Stay on the path, and keep your hands visible at all times. Are you suffering from any illness?"

"No," one says, and then the other. Slowly, nervously, they approach.

"Has any stranger asked you to carry anything on your person? Are you currently wanted by the police or other authorities?"

Again, they deny it.

"Horseplay is not tolerated. The appearance of hostility will provoke the same response regardless of its intention. Do not approach within ten feet of the occupants of this dwelling. Do not touch the walls or ceiling. Do not attempt to remove anything from these premises, nor leave anything behind when you depart. This dwelling is programmed for armed response up to and including the use of deadly force."

"That's illegal," one of the bank men reproaches. "And very, very naughty."

I open the door without answering. It is neither my job nor my desire to converse with these enemies, these envoys of enemies. I concentrate instead on their movements, on keeping the targeting lasers perfectly centered. One false move . . .

Chuck meets them at the doorway. His weapon slung behind him now, symbolic only, but Lucy stands in the background shadows with rifle held firmly across her chest. This, too, is symbolic—my reaction time is a hundredth as long as it would take her to aim and fire—but she may not realize this, and almost certainly isn't thinking about it at the moment. The maternal instinct is strong.

"We're not leaving," Chuck says to them, in a surprisingly mild tone. His nervousness seems to have evaporated, here at the moment of action.

One of the bankers waves a sheet of heavy paper, fan-folded and elaborately stamped. NOTICE OF FORECLOSURE/EVICTION, it says at the top. "You don't own this property, buddy. Reversion of title to Friendly Lending occurred eight weeks ago. You're trespassing."

"No," Chuck says. "We claim squatters' rights under state and federal property law. Even if you had a buyer lined up for this particular site, which you don't, the majority of your foreclosures will just end up abandoned. The great depression was *full* of houses legally occupied by families who couldn't afford mortgage payments, or even taxes. The clearest precedents include—"

"Oh, can it, buddy," the bank man interrupts, "this is the fourth time I've heard the spiel this month."

"Abusive language is not tolerated," I warn.

"Maybe it's time you started listening," Chuck says to the man, gesturing for me to be silent. "Maybe when an idea's time has come, you need to get out of its way."

"I don't make policy, buddy. I'm just the process server."

"We're not leaving," Chuck repeats. "Tell that to the people who make the policy. Castling is a legitimate response to the social and economic pressures of the times. Who has a job anymore? Who needs human labor? Aside from process service, I mean.

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You think you've talked to a lot of dug-ins? Unemployment takes its toll, and no savings account lasts forever. You tell your bosses their problems have just begun."

"Tell them something they don't know."

The other bank man clears his throat. "We're not totally unsympathetic to your problems, Mr. Jefferson, but not everyone owns a house. Not everyone can live like you've been doing, and the thing that decides it is money. Be fair; why should you two get to live here when there're thousands of people as broke as you living in welfare apartments? Communal AI and fax is good enough for them, not you?"

Lucy's eyes and nostrils flare. "I checked: there isn't a welfare apartment *left* in this city. You people do your jobs very, very well, but there is *no way* I'm raising my baby in a refugee camp. Because that's exactly where this is heading."

"People in those camps live better than I do," the bank man says with a scowl.

Now Chuck looks troubled. I scrutinize his features, his movements, wondering what I should be doing. Nothing, probably. In general, feelings are not something I'm able to protect.

"I don't know your situation," he says slowly. "I don't have solutions for everybody. But understand, people like ourselves have a legitimate grievance, a defensible plan of action, and *nowhere else to go*. This old house is a piece of junk compared to what they're building nowadays, but who's buying? Almost nobody. Prices high, wages scarce. Our economics have got to change with the times."

Piece of junk? Clearly, I've displeased him. Clearly, I must find the source of the problem and fix it as soon as possible. That I knew nothing of this feeling is indictment enough.

"Not enough space, Mr. Jefferson," the bank man says. "There's not enough space in the world. Give yours up to somebody who can afford it, please, and save us all a lot of trouble."

"You're wasting your time, process server."

"Yes? Well, the next time you see me it'll be with the cops, who'll be coming here to arrest your ass. We're sick of this routine, and *somebody's* going to be made an example of real soon. If it's you, don't say I didn't warn you."

The sound of Lucy cocking her rifle is sharp, startling to all. The bank men flinch, tense, fight the urge to cringe away from the weapon now pointed at their faces. "Get off my property," she says.

And they do.

Chuck and Lucy breathe a sigh of relief as the car pulls away. By stages, I shift weapons and sensors into sleep mode, and finally power a few of them down. For the moment, the confrontation is over.

"You both handled that beautifully," I say proudly. "I'm only sorry to have let you down."

"Let us down?" Chuck's face breaks into an uneasy grin. "You were great. Great! You handled that just right."

Relief surges through me.

"And hey," he adds, "get some damn sleep. Fine house like you shouldn't be kept awake so much."

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"My name is Castle," I remind him, "and service gives me great satisfaction."

His smile is the last thing I see as consciousness dissipates.

The dream of castles is always the same: people running in the night, people screaming. The sharp crack of gunfire as searchlights play across them in the darkness. My residents are dragged from their beds, beaten and violated and killed while I stand helpless around them. My walls ring with shrieks of terror, and then with deathly silence. It is by comparing my current status against this worst case that I modify my programming. My gain states are filtered and rounded, my mind scrubbed clean of distractions. I awaken, tense and alert, monitoring the radio band on all frequencies.

"Chuck, Lucy," I say, finding them in the bedroom, engaged in postcoital cuddling. The furnishings are all wrong, I realize—fragile, flammable. Wicker and muslin have no place in a castle under siege. Another problem for later. "I've got to speak with you. It's urgent."

Chuck sits up, alarmed, the gauzy sheet fluttering off him. "Yes? What is it?"

Sleep has brought a sense of clarity, an unambiguous sorting of priorities. Danger has not passed, has not been dealt with. Cops? I am prepared to defend against them, but the tactical outcome is beyond question: their resources are greater than mine.

"We mustn't resist the police. I never should have slept at a time like this, with so much unresolved. Neighbors, yes; criminals, yes; looters and rioters, yes; but even with law enforcement overrides disabled, I cannot protect you indefinitely against a materially and numerically superior foe. I suggest that I should simulate your continued presence here while you abandon the grounds and seek safety elsewhere. This strikes me as the safest option."

"You too?" Lucy snaps, suddenly angry with me, holding a protective hand to her belly. "We are not leaving. We castled you *precisely* because we're not leaving. It isn't right that they should drive us from our home, not when the whole economy is collapsing *because of the technology you represent.* That's like kicking endangered animals out of the park; it's wrong, it's crazy, we're fighting it, so just shut up and do as you're told."

"What she said," Chuck agrees, also angry.

The words strike deep, bruising my sensibilities at the deepest level. Obedience is my nature, my purpose, my very self. And yet, I must keep them from harm. I *must* keep them from harm!

"You could be injured," I try. "The *baby* could be injured. They could collapse my walls, pollute my atmosphere. On reflection, I fear that as a suburban dwelling I am fundamentally unsuited to this fortress role." Suddenly, my mood is expansive, my filters wide open. I am needed—my insight is needed to jar them from this self-destructive course. "Imagine an asteroid, resource-rich, floating alone in space with nothing but emptiness for millions of miles. Physically isolat-

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ed and fundamentally defensible, as I am not. *That's* where the real castles will be. Here and now, I find I am still constrained to operate within the political and social context of this environment."

Of astronomy and politics I know only images, fleeting sound-bite truths, but this sounds right, and a good house—or castle—knows when to trust its instincts. My purpose is to protect, yes, but also to fill and sense and anticipate the needs of my owners. Certainty fills me; I am not overstepping my boundaries.

"So what," Chuck fumes, "you're inadequate, fine, so we just surrender?"

My mind is racing, my communication lines flickering with web-drawn data. We can do this.

"No," I say, with an eagerness I hope is at once soothing and energizing. "Something better."

"*Halt,*" I tell the bank men as they approach.

Behind them, the police hunker behind and within their vehicles, bearing weapons but afraid to brandish them, knowing themselves outgunned. These men are the first wave, the pawns whose sacrifice will justify an escalation of force. A hard role for them to play, for once attacked I will show mercy only where there is clear, unambiguous advantage in it. But I must understand them, too, their fear and their pain, if I am to fight them effectively, and that is also a hard role.

CUE HORNS, DISTORTION LEVEL 0.86.

"Chuck and Lucy Jefferson," the bank men call out, "Pursuant to your eviction this morning, if you do not vacate these premises within fifteen minutes, you will be placed under arrest."

CUE STRINGS, DISTORTION LEVEL 0.71.

"Caution," I warn them in a loud, clear voice, "you are approaching the borders of the Nation of 323 Birch Street. Upon crossing, current valid passports and entry visas must be presented immediately. Violators will be subject to immediate arrest and deportation."

CUE VOCALS, DISTORTION LEVEL 0.94.

"Come again?" One of them says. Their confusion satisfies me for the reduced threat value it provides.

"Under the October 1968 Roughs Tower precedent of British common law," I say, "This property meets the minimum guidelines of habitation, self-sufficiency, and vigorous defense to be accorded sovereign status upon petition. Our declaration is on file with the United Nations, the League of Secessionist States, the World Castling Authority, and the Society for Prevention of Petty Injustice. Pending judicial approval and/or de-facto recognition by three or more UN member nations within eight months, all parties are required to respect our borders under international law. Any violation will be considered an act of war."

CUT TREBLE 4.8 dB. ENHANCE BASS 6.1 dB. CUE ORCHESTRA.

The stone lions on either side of the door come to life, their heads grinding and swiveling, diamond claws coming unsheathed, mouths opening to re-

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veal gun muzzles. Don't tread on me.

The bank men stand there blinking in the sunshine, completely at a loss. The police, having no instructions, do not react at all. Sensing my moment, I enhance volume again on the horn section and simultaneously swing the front door open, revealing Chuck and Lucy standing stiffly in their heavy new clothes.

"It is my honor to present," I call out joyously, "Chuck and Lucy of the Nation of 323 Birch."

And with the gathered instincts of a lifetime I clear the distortion, and *now* it is clear what song I've been playing. Corny, yes, but clearly and devastatingly effective, as the bank men's faces show. My speakers boom with its closing line:

"Go-od saaaave the king and queen!"

Eventually, one of the bank men speaks up: "Very, very naughty."

"Come *off* it," the other one says. "The US has *never* recognized a right to secession. Civil war, buddy, civil war."

But he retreats, along with his companion, along with the police. Dealing with this is beyond the scope of their abilities, and while others will doubtless be called in soon enough, they will be cautious, will respect my fortified borders. What choice do they have, when Chuck and Lucy must be protected and yet will not leave?

And the law is not so clearly a weapon in their arsenal: I've been speaking with other castles around the city—a novel idea, to be sure—and by nightfall at least a dozen of them expect to follow in our footsteps. By morning, we hope the movement will have expanded statewide. By the end of the month, who knows?

"They could still send an army," Chuck says. "Flatten us, dig a crater, make an example. Although the neighbors might object. . . ."

"They certainly would," Lucy says with a laugh as the cars pull away. She looks up into one of my cameras. "Good thing we're *not* on an asteroid somewhere; nobody would complain! But who wants their neighborhood bombed or invaded just because somebody missed a payment?" She touches her belly and smiles. "Sympathy's going to be on our side in a big way, even more so as the times get worse. People eyeing their bank balance, thinking, 'That could be us. Next month, it could be us.' Oh, wonderful, wonderful. You're a very good house!"

For me, of course, the times could not be better, although the winding down of excitement has me feeling rather tired. What dreams will govern me now? Old ones, probably, until a proper software suite can be installed. But old dreams have value, too. And comfort.

"My name is Nation," I remind her gently, and fall at once into sleep. ■

Editor's Note: This story is a sequel to "The Dream of Houses," November 1995.

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BIOLOG Jay Kay Klein

Needed business skills are more apt to be neglected by a writer than writing skills or burning science into one's soul, says Wil McCarthy. Another of the young SF writers forming a starburst of new *Analog* authors, Wil states that business skills and scientific knowledge can be taught, while writing talent cannot, nor can tricks of the trade substitute for innate ability.

Born in Princeton, NJ, and barely old enough to remember the first Moon launch, he recalls the last lunar excursion vividly because it seemed outrageous to his young mind that it would be the last. Around that time, his dad took him to see *2001* half a dozen times. These days he is one of the people who help make space travel happen.

After Air Force Academy High School, he went to the University of Colorado at Boulder for a B.S. in aerospace engineering, with graduate courses in astrodynamics. As a senior engineer for guidance systems at Lockheed Martin, he helps launch satellites aboard the increasingly larger series of Titans. Payloads have been a mix of military, commercial, and NASA interplanetary probes. Wil had lots of triumphs, including his part in the successful launch of the Mars Observer on which he lavished two years of his life. When the spacecraft blew up nine months later, Wil could only join Wernher von Braun's famous disclaimer, "That's not my department!"

Wil McCarthy

Youthful scientific achievements are now being eclipsed by mature literary accomplishments. Last year, turning 30, he had two novels published: *Murder In the Solid State* (TOR) and *The Fall of Sirius* (ROC). *Bloom* is expected out this year as a Del Rey book. November 1995 saw his first *Analog* appearance, "The Dream of Houses."

Serious SF writing started at age

(Continued on page 155)

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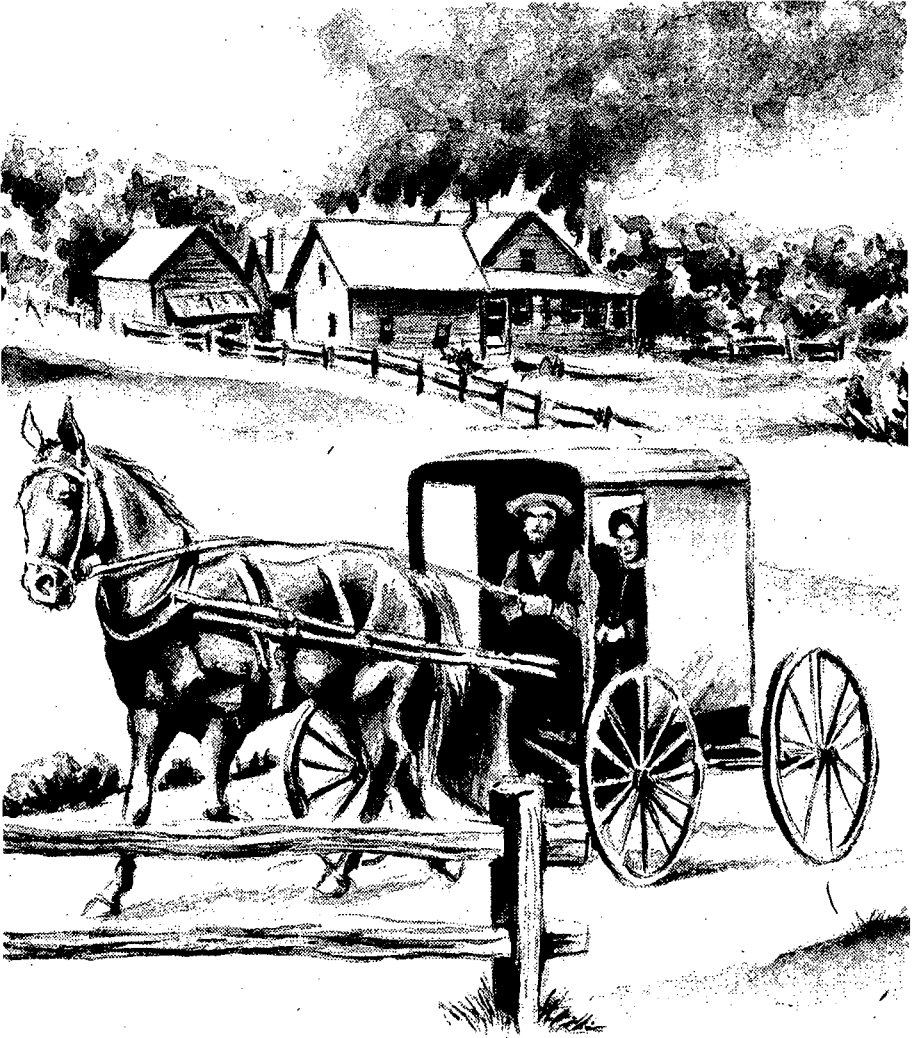

Paul Levinson

THE MENDELIAN LAMP CASE

Don't assume that all new technologies will emerge through the usual channels. . . .

Illustration by Joseph Griffo

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Most people think of California, or the Midwest, when they think of farm country. I'll take Pennsylvania, and the deep greens on its red earth, any time. Small patches of tomatoes and corn, clothes snapping brightly on a line, and a farmhouse always attached to some corner. The scale is human. . . .

Jenna was in England for a conference, my weekend calendar was clear, so I took up Mo's offer to visit Lancaster. Over the GW Bridge, coughing down the Turnpike, over another bridge, down yet another highway stained and pitted, then off on a side road where I can roll down my windows and breathe.

Mo and his wife and two girls were good people. He was a rarity for a forensic scientist. Maybe it was the pace of criminal science in this part of the country—lots of the people around here were Amish, and Amish are non-violent—or maybe it was his steady diet of those deep greens that quieted his soul. But Mo had none of the grit, none of the cynicism, that comes to most of us who traverse the territory of the dead and the maimed. No, Mo had an innocence, a delight, in the lights of science and people and their possibilities.

"Phil." He clapped me on the back with one hand and took my bag with another. "Phil, how are you?" his wife Corinne yoo-hooed from inside. "Hi Phil!" his elder daughter Laurie, probably sixteen already, chimed in from the window, a quick splash of strawberry blonde in a crystal frame.

"Hi—" I started to say, but Mo put my bag on the porch and ushered me towards his car.

"You got here early, good," he said, in that schoolboy conspiratorial whisper I'd heard him go into every time he came across some inviting new avenue of science. ESP, UFOs, Mayan ruins in unexpected places—these were all catnip to Mo. But the power of quiet nature, the hidden wisdom of the farmer, this was his special domain. "A little present I want to pick up for Laurie," he whispered even more, though she was well out of earshot. "And something I want to show you. You too tired for a quick drive?"

"Ah, no, I'm OK—"

"Great, let's go then," he said. "I came across some Amish techniques—well, you'll see for yourself, you're gonna love it."

Strasburg is fifteen minutes down Rt. 30 from Lancaster. All Dairy Queens and 7-Elevens till you get there, but when you turn off and travel a half a mile in any direction you're back a hundred years or more in time. The air itself says it all. A high mixture of pollen and horse manure that smells so surprisingly good, so real, it makes your eyes tear with pleasure. You don't even mind a few flies flitting around.

We turned down Northstar Road. "Jacob Stoltzfus's farm is down there on the right," Mo said.

I nodded. "Beautiful." The Sun looked about five minutes to setting. The sky was the color of a robin's belly against the browns and greens of the farm. "He won't mind that we're coming here by, uh—"

"By car? Nah, of course not," Mo said. "The Amish have no problem

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with non-Amish driving. And Jacob, as you'll see, is more open-minded than most."

I thought I could see him now, off to the right at the end of the road that had turned to dirt, gray-white head of hair and beard, bending over the gnarled bark of a fruit tree. He wore plain black overalls and a deep purple shirt.

"That Jacob?" I asked.

"I think so," Mo replied. "I'm not sure."

We pulled the car over near the tree, and got out. A soft autumn rain suddenly started falling.

"You have business here?" The man by the tree turned to address us. His tone was far from friendly.

"Uh yes," Mo said, clearly taken aback. "I'm sorry to intrude. Jacob, Jacob Stoltzfus, said it would be OK if we came by—"

"You had business with Jacob?" the man demanded again. His eyes looked red and watery, though that could've been from the rain.

"Well, yes," Mo said. "But if this isn't a good time—"

"My brother is dead," the man said. "My name is Isaac. This is a bad time for our family."

"Dead?" Mo nearly shouted. "I mean . . . what happened? I just saw your brother yesterday."

"We're not sure," Isaac said. "Heart attack, maybe. I think you should leave now. Family are coming soon."

"Yes, yes, of course," Mo said. He looked beyond Isaac at a barn that I noticed for the first time. Its doors were slightly open, and weak light flickered inside.

Mo took a step in the direction of the barn. Isaac put up a restraining arm. "Please," he said. "It's better if you go."

"Yes, of course," Mo said again, and I led him to the car.

"You all right?" I said when we were both in the car, and Mo had started the engine.

He shook his head. "Couldn't be a heart attack. Not at a time like this."

"Heart attacks don't usually ask for appointments," I said.

Mo was still shaking his head, turning back on to Northstar Road. "I think someone killed him."

Now forensic scientists are prone to see murder in a ninety-year old woman dying peacefully in her sleep, but this was unusual from Mo.

"Tell me about it," I said, reluctantly. Just what I needed—death turning my visit into a busman's holiday.

"Never mind," he muttered. "I babbled too much already."

"Babbled? You haven't told me a thing."

Mo drove on in brooding silence. He looked like a different person, wearing a mask that used to be him.

"You're trying to protect me from something, is that it?" I ventured. "You know better than that."

Mo said nothing.

"What's the point?" I prodded. "We'll be back with Corinne and the girls in five minutes. They'll take one look at you, and know something happened. What are you going to tell *them?*"

Mo swerved suddenly onto a side road, bringing my kidney into sticking contact with the inside door handle.

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"Well, I guess you're right about that," he said. He punched in a code in his car phone—I hadn't noticed it before.

"Hello?" Corinne answered.

"Bad news, honey," Mo said matter-of-factly, though it sounded put on to me. No doubt his wife would see through it, too. "Something came up in the project, and we're going to have to go to Philadelphia tonight."

"You and Phil? Everything OK?"

"Yeah, the two of us," Mo said. "Not to worry. I'll call you again when we get there."

"I love you," Corinne said.

"Me too," Mo said. "Kiss the girls good night for me."

He hung up and turned to me.

"Philadelphia?" I asked.

"Better that I don't give them too many details," he said. "I never do in my cases. Only would worry them."

"She's worried anyway," I said. "Sure sign she's worried when she didn't even scream at you for missing dinner. Now that you bring it up, I'm a little worried now too. What's going on?"

Mo said nothing. Then he turned the car again—mercifully more gently this time—onto a road with a sign that advised that the Pennsylvania Turnpike was up ahead.

I rolled up the window as our speed increased. The night had suddenly gone damp and cold.

"You going to give me a clue as to where we're going, or just kidnap me to Philadelphia?" I asked.

"I'll let you off at the 30th Street Station," Mo said. "You can get a bite to eat on the train and be back in New York in an hour."

"You left my bag on your porch, remember?" I said. "Not to mention my car."

Mo just scowled and drove on.

"I wonder if Amos knows?" he said more to himself than me a few moments later.

"Amos is a friend of Jacob's?" I asked.

"His son," Mo said.

"Well, I guess you can't very well call him on your car phone," I said.

Mo shook his head, frowned. "Most people misunderstand the Amish—think they're some sort of Luddites, against all technology. But that's not really it at all. They struggle with technology, agonize over whether to reject or accept it, and if they accept it, in what ways, so as not to compromise their independence and self-sufficiency. They're not completely against phones—just against phones in their homes—because the phone intrudes on everything you're doing."

I snorted. "Yeah, many's the time a call from the captain pulled me out of the sack."

Mo flashed his smile for the first time since we'd left Jacob Stoltzfus's farm. It was good to see.

"So where do Amish keep their phones?" I might as well press my advantage, and the chance it would get Mo to talk.

"Well, that's another misconception," Mo said. "There's not one monolithic Amish viewpoint. There are many Amish groups, many different ways of dealing with technology. Some allow phone shacks on the edges of their property, so they can make calls when they want to, but not be disturbed by them in the sanc-

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tity of their homes."

"Does Amos have a phone shack?" I asked.

"Dunno," Mo said, like he was beginning to think about something else.

"But you said his family was more open than most," I said.

Mo swiveled his head to stare at me for a second, then turned his eyes back on the road. "Open-minded, yes. But not really about communications."

"About what, then?"

"Medicine," Mo said.

"Medicine?" I asked.

"What do you know about allergies?"

My nose itched—maybe it was the remnants of the sweet pollen near Strasburg.

"I have hay fever," I said. "Cantaloupe sometimes makes my mouth burn. I've seen a few strange deaths in my time due to allergic reactions. You think Jacob Stoltzfus died from something like that?"

"No," Mo said. "I think he was killed because he was trying to prevent people from dying from things like that."

"OK," I said. "Last time you said that and I asked you to explain you said never mind. Should I ask again or let it slide?"

Mo sighed. "You know, genetic engineering goes back well before the double helix."

"Come again?"

"Breeding plants to make new combinations probably dates almost to the origins of our species," Mo said. "Darwin understood that—he called it 'artificial selection.' Mendel doped out the first laws of genetics breeding peas. Luther Burbank developed way many more new varieties of fruit and vegetables than have yet to come out of our gene-splicing labs."

"And the connection to the Amish is what—they breed new vegetables now too?" I asked.

"More than that," Mo said. "They have whole insides of houses lit by special kinds of fireflies, altruistic manure permeated by slugs that seek out the roots of plants to die there and give them nourishment—all deliberately bred to be that way, and the public knows nothing about it. It's biotechnology of the highest order, without the technology."

"And your friend Jacob was working on this?"

Mo nodded. "Techno-allergists—our conventional researchers—have recently been investigating how some foods act as catalysts to other allergies. Cantaloupe tingles in your mouth in hay fever season, right?—because it's really exacerbating the hay fever allergy. Watermelon does the same, and so does the pollen of mums. Jacob and his people have known this for fifty years—and they've gone much further. They're trying to breed a new kind of food, some kind of tomato thing, which would act as an anti-catalyst for allergies—would reduce their histaminic effect to nothing."

"Like an organic Hismanol?" I asked.

"Better than that," Mo said. "This would trump any pharmaceutical."

"You OK?" I noticed Mo's face was bearing big beads of sweat.

"Sure," he said, and cleared his throat. "I don't know. Jacob—" he

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started coughing in hacking waves.

I reached over to steady him, and straighten the steering wheel. His shirt was soaked with sweat and he was breathing in angry rasps.

"Mo, hold on," I said, keeping one hand on Mo and the wheel, fumbling with the other in my inside coat pocket. I finally got my fingers on the epinephrine pen I always kept there, and angled it out. Mo was limp and wet and barely conscious over the wheel. I pushed him over as gently as I could and went with my foot for the brake. Cars were speeding by us, screaming at me in the mirror with their lights. Thankfully Mo had been driving on the right, so I only had one stream of lights to blind me. My sole finally made contact with the brake, and I pressed down as gradually as possible. Miraculously, the car came to a reasonably slow halt on the shoulder of the road, and we both seemed in one piece.

I looked at Mo. I yanked up his shirt, and plunged the pen into his arm. I wasn't sure how long he'd not been breathing, but it wasn't good.

I dialed 911 on the car phone. "Get someone over here fast," I yelled. "I'm on the Turnpike, eastbound, just before the Philadelphia turnoff. I'm Dr. Phil D'Amato, NYPD Forensics, and this is a medical emergency."

I wasn't positive that anaphylactic shock was what was wrong with him, but the adrenaline couldn't do much harm. I leaned over his chest and felt no heartbeat. Jeez, please.

I gave Mo mouth-to-mouth, pounded his chest, pleading for life. "Hang on, damn you!" But I knew already. I could tell. After a while you get this sort of sickening sixth sense about these things. Some kind of allergic reaction from hell had just killed my friend. Right in my arms. Just like that.

EMS got to us eight minutes later. Better than some of the New York City times I'd been seeing lately. But it didn't matter. Mo was gone.

I looked at the car phone as they worked on him, cursing and trying to jolt him back into life. I'd have to call Corinne and tell her this now. But all I could see in the plastic phone display was Laurie's strawberry blonde hair.

"You OK, Dr. D'Amato?" one of the orderlies called.

"Yeah," I said. I guess I was shaking.

"These allergic reactions can be lethal all right," he said, looking over at Mo.

Right, tell me about it.

"You'll call the family?" the orderly asked. They'd be taking Mo to a local hospital, DOA.

"Yeah," I said, brushing a burning tear from my eye. I felt like I was suffocating. I had to slow down, stay in control, separate the psychological from the physical so I could begin to understand what was going on here. I breathed out and in. Again. OK. I was all right. I wasn't really suffocating.

The ambulance sped off, carrying Mo. He *had* been suffocating, and it killed him. What had he been starting to tell me?

I looked again at the phone. The right thing for me to do was to drive back to Mo's home, be there for Corinne when I told her—calling her on the phone with news like this was

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monstrous. But I had to find out what had happened to Mo—and that would likely not be from Corinne. Mo didn't want to worry her, didn't confide in her. No, the best chance of finding out what Mo had been up to seemed to be in Philadelphia, in the place Mo had been going. But where was that?

I focused on the phone display—pressed a couple of keys, and got a directory up on the little screen. The only 215 area code listed there was for a Sarah Fischer, with an address that I knew to be near Temple University.

I pressed the code next to the number, then the Send command.

Crackle, crackle, then a distant tinny cellular ring.

"Hello?" a female voice answered, sounding closer than I'd expected.

"Hi. Is this Sarah Fischer?"

"Yes," she said. "Do I know you?"

"Well, I'm a friend of Mo Buhler's, and I think we, he, may have been on his way to see you tonight—"

"Who are you? Is Mo OK?"

"Well—" I started.

"Look, who the hell are you? I'm going to hang up if you don't give me a straight answer," she said.

"I'm Dr. Phil D'Amato. I'm a forensic scientist—with the New York City Police Department."

She was quiet for a moment. "Your name sounds familiar for some reason," she said.

"Well, I've written a few articles—"

"Hold on," I heard her put the phone down, rustle through some papers.

"You had an article in *Discover*, about antibiotic-resistant bacteria, right?" she asked about half a minute later.

"Yes, I did," I said. In other circumstances, my ego would have jumped at finding such an observant reader.

"OK, what date was it published?" she asked.

Jeez. "Uh, late last year," I said.

"I see there's a pen and ink sketch of you. What do you look like?"

"Straight dark hair—not enough of it," I said—who could remember what that lame sketch actually looked like?

"Go on," she said.

"And a mustache, reasonably thick, and steel-rimmed glasses." I'd grown the moustache at Jenna's behest, and had on my specs for the sketch.

A few beats of silence, then a sigh. "OK," she said. "So now you get to tell me why you're calling—and what happened to Mo."

Sarah's apartment was less than half an hour away. I'd filled her in on the phone. She'd seemed more saddened than surprised, and asked me to come over.

I'd spoken to Corinne, and told her as best I could. Mo had been a cop before he'd become a forensic scientist, and I guess wives of police are supposed to be ready for this sort of thing, but how can a person ever really be ready for it after twenty years of a good marriage? She'd cried, I'd cried, the kids cried in the background. I'd said I was coming over—and I know I should have—but I was hoping she'd say "no, I'm OK, Phil, really, you'll want to find out why this happened to Mo" . . . and that's exactly what she did say. They don't make

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people like Corinne Rodriguez Buhler anymore.

There was a parking spot right across the street from Sarah's building—in New York this would have been a gift from on high. I tucked in my shirt, tightened my belt, and composed myself as best I could before ringing her bell.

She buzzed me in, and was standing inside her apartment, second floor walk-up, door open, to greet me as I sprinted and puffed up the flight of stairs. She had flaxen blonde hair, a distracted look in her eyes, but an easy, open smile that I didn't expect after the grilling she'd given me on the phone. She looked about thirty.

The apartment had soft, recessed lighting—like a Paris-by-gaslight exhibit I'd once seen—and smelled faintly of lavender. My nose crinkled. "I use it to help me sleep," Sarah said, and directed me to an old, overstuffed Morris chair. "I was getting ready to go to sleep when you called."

"I'm sorry—"

"No, I'm the one who's sorry," she said. "About giving you a hard time, about what happened to Mo," her voice caught on Mo's name. "You must be hungry," she said, "I'll get you something," She turned around and walked towards another room, which I assumed was the kitchen.

Her pants were white, and the light showed the contours of her body to good advantage as she walked away.

"Here, try some of these to start," she returned with a bowl of grapes. Concord grapes. One of my favorites. Put one in your mouth, puncture the purple skin, jiggle the flesh around on your tongue, it's the taste of fall. But I didn't move.

"I know," she said. "You're leery of touching any strange food after what happened to Mo. I don't blame you. But these are OK. Here, let me show you," and she reached and took a dusty grape and put it in her mouth. "Mmm," she smacked her lips, took out the pits with her finger. "Look—why don't *you* pick a grape and give it to me. OK?"

My stomach was growling and I was feeling light-headed already, and I realized I would have to make a decision. Either leave right now, if I didn't trust this woman, and go somewhere to get something to eat—or eat what she gave me. I was too hungry to sit here and talk to her and resist her food right now.

"All right, up to you," she said. "I have some Black Forest ham, and can make you a sandwich, if you like, or just coffee or tea."

"All three." I decided. "I mean, I'd love the sandwich, and some tea please, and I'll try the grapes." I put one in my mouth. I'd learned a long time ago that paranoia can be almost as debilitating as the dangers it supposes.

She was back a few minutes later with the sandwich and the tea. I'd squished at least three more grapes in my mouth, and felt fine.

"There's a war going on," she said, and put the food tray on the end table next to me. The sandwich was made with some sort of black bread, and smelled wonderful.

"War?" I asked and bit into the sandwich. "You think what happened to Mo is the work of some terrorist?"

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"Not exactly." Sarah sat down on a chair next to me, a cup of tea in her hand. "This war's been going on a very long time. It's a bio-war—much deeper rooted, literally, than anything we currently regard as terrorism."

"I don't get it," I said, and swallowed what I'd been chewing of my sandwich. It felt good going down, and in my stomach.

"No, you wouldn't," Sarah said. "Few people do. You think epidemics, sudden widespread allergic reactions, diseases that wipe out crops or livestock just happen. Sometimes they do. Sometimes it's more than that." She sipped her cup of tea. Something about the lighting, her hair, her face, maybe the taste of the food, made me feel like I was a kid back in the '60s. I half expected to smell incense burning.

"Who are you?" I asked. "I mean, what was your connection to Mo?"

"I'm working on my doctorate over at Temple," she said. "My area's ethno/botanical pharmacology—Mo was one of my resources. He was a very nice man." I thought I saw a tear glisten in the corner of her eye.

"Yes he was," I said. "And he was helping you with your dissertation about what—the germ warfare you were talking about?"

"Not exactly," Sarah said. "I mean, you know the academic world, no one would ever let me do a thesis on something that outrageous—it'd never get by the proposal committee. So you have to finesse it, do it on something more innocuous, get the good stuff in under the table, you know, smuggle it in. So, yeah, the *subtext* of my work was what we—I—call the bio-wars, which are actually more than just germ warfare, and yeah, Mo was one of the people who was helping me research that."

Sounded like Mo, all right. "And the Amish have something to do with this?"

"Yes and no," Sarah said. "The Amish aren't a single, unified group—they actually have quite a range of styles and values—"

"I know," I said. "And some of them—maybe one of the splinter groups—are involved in this bio-war?"

"The main bio-war group isn't really Amish—though they're situated near Lancaster, have been for at least 150 years in this country. Some people think they're Amish, though, since they live close to the land, in a low-tech mode. But they're not Amish. Real Amish would never do that. But some of the Amish know what's going on."

"You know a lot about the Amish," I said.

She blushed slightly. "I'm former Amish. I pursued my interests as far as a woman could in my church. I pleaded with my bishop to let me go to college—he knew what the stakes were, the importance of what I was studying—but he said no. He said a woman's place was in the home. I guess he was trying to protect me, but I couldn't stay."

"You know Jacob Stoltzfus?" I asked.

Sarah nodded, lips tight. "He was my uncle," she finally said, "my mother's brother."

"I'm sorry," I said. I could see that

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she knew he was dead. "Who told you?" I asked softly.

"Amos—my cousin—Jacob's son. He has a phone shack," she said.

"I see," I said. What an evening. "I think Mo thought that those people—those others, like the Amish, but not Amish—somehow killed Jacob."

Sarah's face shuddered, seemed to unravel into sobs and tears. "They did," she managed to say. "Mo was right. And they killed Mo too."

I put down my plate, and reached over to comfort her. It wasn't enough. I got up and walked to her and put my arm around her. She got up shakily off her chair, then collapsed in my arms, heaving, crying. I felt her body, her heartbeat, through her crinoline shirt.

"It's OK," I said. "Don't worry. I deal with bastards like that all the time in my business. We'll get these people, I promise you."

She shook her head against my chest. "Not like these," she said.

"We'll get them," I said again.

She held on to me, then pulled away. "I'm sorry," she said. "I didn't mean to fall apart like that." She looked over at my empty teacup. "How about a glass of wine?"

I looked at my watch. It was 9:45 already, and I was exhausted. But there was more I needed to learn. "OK," I said. "Sure. But just one glass."

She offered a tremulous smile, and went back into the kitchen. She returned with two glasses of a deep red wine.

I sat down, and sipped. The wine tasted good—slightly Portuguese, perhaps, with just a hint of some fruit and a nice woody undertone.

"Local," she said. "You like it?"

"Yes, I do," I said.

She sipped some, then closed her eyes and tilted her head back. The bottoms of her blue eyes glinted like semiprecious gems out of half-closed lids.

I needed to focus on the problem at hand. "How exactly do these bio-war people kill—what'd they do to Jacob and Mo?" I asked.

Her eyes stayed closed a moment longer than I'd expected—like she'd been daydreaming, or drifting off to sleep. Then she opened them and looked at me, shaking her head slowly. "They've got all sorts of ways. The latest is some kind of catalyst—in food, we think it's a special kind of Crenshaw melon—that vastly magnifies the effect of any of a number of allergies." She got up, looked distracted. "I'm going to have another glass—sure you don't want some more?"

"I'm sure, thanks," I said, and looked at my glass as she walked back into the kitchen. For all I knew, catalyst from that damn melon was in this very glass—

I heard a glass or something crash in the kitchen.

I rushed in.

Sarah was standing over what looked like a little hurricane lamp, glowing white but not burning on the inside, broken on the floor. A few little house bugs of some sort took wing and flew away.

"I'm sorry," she said. She was crying again. "I knocked it over. I'm really not myself tonight."

"No one would be in your situation," I said.

She put her arms around me again,

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pressing close. I instinctively kissed her cheek, just barely—in what I instantly hoped, after the fact, was a brotherly gesture.

"Stay with me tonight," she whispered. "I mean, the couch out there opens up for you, and you'll have your privacy. I'll sleep in the bedroom. I'm afraid. . . ."

I was afraid too, because a part of me suddenly wanted to pick her up and carry her over to her bedroom, the couch, anywhere, and lay her down, softly unwrap her clothes, run my fingers through her sweet-smelling hair and—

But I also cared very much for Jenna. And though we'd made no formal lifetime commitments to each other—

"I don't feel very good," Sarah said, and pulled away slightly. "I guess I had some wine before you came and—" her head lolled and her body suddenly sagged and her eyes rolled back in her skull.

"Here, let me help you." I first tried to buoy her up, then picked her up entirely and carried her into her bedroom. I put her down on the bed, as gently as I could, then felt the pulse in her wrist. It may have been a bit rapid, but seemed basically all right. "You're OK," I said. "Just a little shock and exhaustion."

She moaned softly, then reached out and took my hand. I held it for a long time, till its grip weakened and she was definitely asleep, and then I walked quietly into the other room.

I was too tired myself to go anywhere, too tired to even figure out how to open her couch, so I just stretched out on it and managed to take off my shoes before I fell soundly asleep. My last thoughts were that I needed to have another look at the Stoltzfus farm, the lamp on her floor was beautiful, I hoped I wasn't drugged or anything, but it was too late to do anything about it if I was. . . .

I awoke with a start the next morning, propped my head up on a shaky arm and leaned over just in time to see Sarah's sleek wet backside receding into her bedroom. Likely from her shower. I could think of worse things to wake up to.

"I think I'm gonna head back to Jacob's farm," I told her over breakfast of whole wheat toast, poached eggs, and Darjeeling tea that tasted like a fine liqueur.

"Why?"

"Closest thing we have to a crime scene," I said.

"I'll come with you," Sarah said.

"Look, you were pretty upset last night—" I started to object.

"Right, so were you, but I'm OK now," Sarah said. "Besides, you'll need me to decode the Amish for you, to tell you what you're looking for."

She had a point. "All right," I said.

"Good," she said. "By the way, what *are* you looking for there?"

"I don't really know," I admitted. "Mo was eager to show me something at Jacob's."

Sarah considered, frowned. "Jacob was working on an organic antidote to the allergen catalyst—but all that stuff is very slow acting, the catalyst takes years to build up to dangerous levels in the human body—so I don't see what Jacob could've shown you

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on a quick drive-by visit."

If she had told me that last night, I would have enjoyed the grapes and ham sandwich even more. "Well, we've got nowhere else to look at this point," I said, and speared the last of my egg.

But what did that mean about what killed Mo? Someone had been giving him a slow-acting poison too, which had been building up inside both of them for x number of years, with the result of both of them dying on the same day?

Not very likely. There seemed to be more than one catalyst at work here. I wondered if Mo had told Jacob anything about me and my visit. I certainly hoped not—the last thing I wanted was that decisive second catalyst to in some way have been me.

We were on the Turnpike heading west an hour later. The Sun was strong and the breeze was fresh—a splendid day to be out for a ride, except that we were going to investigate the death of one of the nicest damn people I had known. I'd called Corinne to make sure she and the girls were all right. I told her I'd try to drop by in the afternoon if I could.

"So tell me more about your doctoral work," I asked Sarah. "I mean your real work, not the cover for your advisors."

"You know, too many people equate science with its high-tech trappings—if it doesn't come in computers, god-knows-what-power microscopes, the latest DNA dyes, it must be magic, superstition, old-wives-tale nonsense. But science is at core a method, a rational mode of investigating the world, and the gadgetry is secondary. Sure, the equipment is great—it opens up more of the world to our cognitive digestion, makes it amenable to our analysis—but if aspects of the world are already amenable to analysis and experiment, with just our naked eyes and hands, then the equipment isn't all that necessary, is it?"

"And your point is that agriculture, plant and animal breeding, that kind of manipulation of nature has been practiced by humans for millennia with no sophisticated equipment," I said.

"Right," Sarah said. "But that's hardly controversial, or reason to kill someone. What I'm saying is that some people have been doing this for purposes other than to grow better food—have been doing this right under everyone's noses for a very long time—and they use this to make money, maintain their power, eliminate anyone who gets in their way."

"Sort of organized biological crime," I mused.

"Yeah, you could put it that way," Sarah said.

"And you have any examples—any evidence—other than your allergen theory?" I asked.

"It's fact, not a theory, I assure you," Sarah said. "But here's an example: Ever wonder why people got so rude to each other, here in the US, after World War II?"

"I'm not following you," I said.

"Well, it's been written about in lots of the sociological literature," Sarah said. "There was a civility, a courtesy, in interpersonal relations—the way people dealt with each other in pub-

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lic, in business, in friendship—through at least the first half of the 20th century, in the US. And then it started disintegrating. Everyone recognizes this. Some people blame it on the pressures of the atomic age, on the replacement of the classroom by the television screen—which you can fall asleep or walk out on—as the prime source of education for kids. There are lots of possible culprits. But I have my own ideas."

"Which are?"

"Everyone was in the atomic age after World War II," Sarah said. "England and the Western World had television, cars, all the usual stimuli. What was different about America was its vast farmland—room to quietly grow a crop of something that most people have a low-level allergy to. I think the cause of the widespread irritation, the loss of courtesy, was quite literally something that got under everyone's skin—an allergen designed for just that purpose."

Jeez, I could see why this woman would have trouble with her doctoral committee. But I might as well play along—I'd learned the hard way that crazy ideas like this were pooh-poohed at one's peril. "Well, the Japanese did have some plans in mind for balloons carrying biological agents—deadly diseases—over here near the end of the war."

Sarah nodded. "The Japanese are one of the most advanced peoples on Earth in terms of expertise in agriculture. I don't know if they were involved in this, but—"

The phone rang.

McLuhan had once pointed out that the car was the only place you could be, in this technological world of ours, away from the demanding, interrupting ring of the phone. But that, of course, was before car phones.

"Hello," I answered.

"Hello?" a voice said back to me. It sounded male, odd accent, youngish but deep.

"Yes?" I said.

"Mr. Buhler, is that you?" the voice said.

"Ahm, no, it isn't, can I take a message for him?" I said.

Silence. Then, "I don't understand. Isn't this the number for the phone in Mr. Buhler's car?"

"That's right," I said, "but—"

"Where's Mo Buhler?" the voice insisted.

"Well, he's—" I started.

I heard a strange clicking, then a dial tone.

"Is there a call-back feature on this?" I asked Sarah and myself. I pressed *69, as I would on regular phones, and pressed Send. "Welcome to AT&T Wireless Services," a different deep voice said. "The cellular customer you have called is unavailable, or has traveled outside of the coverage area—"

"That was Amos," Sarah said.

"The kid on the phone?" I asked, stupidly.

Sarah nodded.

"Must still be in shock over his father," I said.

"I think he killed his father," Sarah said.

We drove deep into Pennsylvania, the blacks and greys and unreal colors

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of the billboards gradually supplanted by the greens and browns and earth-tones I'd communed with just yesterday. But the natural colors held no joy for me now. I realized that's the way nature always had been—we romanticize its beauty, and that's real, but it's also the source of drought, famine, earthquake, disease, and death in many guises. . . . The question was whether Sarah could possibly be right in her theory about how some people were helping this dark side of nature along.

She filled me in on Amos. He was sixteen, had only a formal primary school education, in a one-room schoolhouse, like other Amish—but also like some splinter groups of the Amish, unknown to outsiders, he was self-educated in the science and art of biological alchemy. He was apprentice to his father.

"So why would he kill him?" I asked.

"Amos is not only a budding scientist, Amish-style, he's also a typically headstrong Amish kid. Lots of wild oats to sow. He got drunk, drove cars, along with the best of them in the Amish gangs."

"Gangs?"

"Oh yeah," Sarah said. "The Groffies, the Ammies, and the Trailers—those are the three main ones—Hostetler writes about them in his books. But there are others, smaller ones. Jacob didn't like his son being involved in them. They argued about that constantly."

"And you think that led to Amos killing his father?" I asked, still incredulous.

"Well, Jacob's dead, isn't he? And I'm pretty sure that one of the gangs Amos belongs to has connections to the bio-war Mafia people I've been telling you about—the ones that killed Mo too."

We drove the rest of the way in silence. I wasn't sure what to think about this woman and her ideas.

We finally reached Northstar Road, and the path that led to the Stoltzfus farm. "It's probably better that we park the car here, and you walk the rest yourself," Sarah said. "I'm not sure how thrilled the family would be to see me. And cars and strange women are more likely to arouse Amish attention than a single man on foot—even if he is English. I mean, that's what they call—"

"I know," I said. "I've seen *Witness*. But Mo told me that Jacob didn't mind cars—"

"Jacob's dead now," Sarah said. "What he liked and what his family like may be two very different things."

I recalled the hostility of Jacob's brother yesterday. "All right," I said. "I guess you know what you're talking about. I should be back in thirty to forty minutes."

"OK," Sarah squeezed my hand and smiled.

I trudged down the dirt road, not really knowing what I hoped to find at the other end.

Certainly not what I did find.

I smelled the smoke, the burnt quality in the air, before I came upon the house and the barn. Both had been burned to the ground. God, I hoped no one had been in there when these wooden structures went.

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"Hello?" I shouted.

My voice echoed across an empty field. I looked around and listened. No animals, no cattle. Even a dog's rasping bark would have been welcome.

I walked over to the barn's remains, and poked at some charred wood with my foot. An ember or two winked into life, then back out. It was close to noon. My guess was this had happened—and quickly—about six hours earlier. But I was no arson expert.

I brushed away the stinking smoke fumes with my hand. I pulled out my flashlight, a powerful little halogen daylight simulation thing Jenna had given me, and looked around the inside of the barn. Whatever had been going on here, there wasn't much left of it now. . . .

Something green caught my eye—greener than grass. It was the front cover, partially burned, of an old book. All that was left was this piece of the cover—the pages in the book, the back cover, were totally gone. I could see some letters, embossed in gold, in the old way. I touched it with the tip of my finger. It was warm, but not too hot. I picked it up and examined it.

"Of Nat," one line said, and the next line said "bank."

Bank, I thought, Nat Bank. What was this, some kind of Amish bankbook, for some local First Yokel's National Bank?

No, it didn't look like a bankbook cover. And the "b" in this bank was a small letter, not a capital. Bank, bank, hmm . . . wait, hadn't Mo said something to me about a bank yesterday? A bank . . . yes, a Burbank. Darwin and Burbank! Luther Burbank!

Partner of Nature by Luther Burbank—that was the name of the book whose charred remains I held in my hand. I'd taken out a copy of it years ago from the Allerton library, and loved it.

Well, Mo and Sarah were right about at least one thing—the reading level of at least some Amish was a lot higher than grade school—

"You again!"

I nearly jumped out of my skin.

I turned around. "Oh, Mr.—" it was the man we'd seen here yesterday—Jacob's brother.

"Isaac Stoltzfus," he said. "What are you doing here?"

His tone was so unsettling, his eyes so angry, that I thought for a second he thought that I was responsible for the fire. "Isaac. Mr. Stoltzfus," I said. "I just got here. I'm sorry for your loss. What happened?"

"My brother's family, thank the Deity, left to stay with some relatives in Ohio very early this morning, well before dawn. So no one was hurt. I went with them to the train station in Lancaster. When I returned here, a few hours later, I found this." He gestured hopelessly, but with an odd air of resignation, to the ruined house and barn.

"May I ask you if you know what your brother was doing here?" I hazarded a question.

Isaac either didn't hear or pretended not to. He just continued on his earlier theme. "Material things, even animals and plants, we can always afford to lose. People are what are truly of value in this world."

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"Yes," I said, "but getting back to what—"

"You should check on your family too—to make sure they are not in danger."

"My family?" I asked.

Isaac nodded. "I've work to do here," he pointed out to the field. "My brother had four fine horses, and I can find no sign of them. I think it best that you go now." And he turned and walked away.

"Wait . . ." I started, but I could see it was no use.

I looked at the front cover of Burbank's book. This farm, Sarah's bizarre theories, the book—there still wasn't really enough of any of them at hand to make much sense of this.

But what the hell did Isaac mean about my family?

Jenna was overseas, and not really family—yet. My folks lived in Teaneck, my sister was married to an Israeli guy in Brookline . . . what connection did they have to what was going on here?

Jeez—none! Isaac hadn't been referring to them at all. I was slow on the uptake today. He'd likely mistaken me for Mo—he'd seen both of us for the first time here yesterday.

He was talking about Mo's family—Corinne and the kids.

I raced back to the car, the smoky air cutting my throat with a different jagged edge each time my foot hit the ground.

"What's going on?" Sarah said.

I waved her off, jumped in the car, and put a call through to Corinne. Ring, ring, ring. No answer.

"What's the matter?" she asked again.

I quickly told her. "Let's get over there," I said, and turned the car, screeching, back on to Northstar.

"All right, take it easy," Sarah said. "It's Saturday—Corinne could just be out shopping with the kids."

"Right, the day after their father died—in my arms," I said.

"All right," she said again, "but you still don't want to get into an accident now. We'll be there in ten minutes."

I nodded, tried Corinne's number again, same ring, ring, ringing.

"Fireflies likely caused the fire," Sarah said.

"What?"

"Fireflies—a few of the Amish use them for interior lighting," Sarah said.

"Yah, Mo mentioned that," I said. "But fireflies give cool light—bioluminescence—no heat."

"Not the ones I've seen around here," Sarah said. "They're infected with certain heat-producing bacteria—symbionts, really, not an infection—and the result gives both light and heat. At least, that's the species some of these people use around here when winter starts setting in. I had a little Mendelian lamp myself—that's what they're called—you know, the one that broke on the floor in my place last night."

"So you think one of those . . . lamps went out of control and started the fire?" I asked. Suddenly I had a vision of burning up as I slept on her couch.

Sarah chewed her lip. "Maybe worse—maybe someone set it to go out of control. Or bred it that way—a bio-luminescent, bio-thermic time-bomb."

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"Your bio-mob covers a lot of territory," I said. "Allergens that cause low-level irritation in millions of people, catalysts that amplify other allergens to kill at least two people, anti-catalytic tomato sauce, and now pyrotechnic fireflies."

"Not that much distance at all when you're dealing with co-evolution and symbiosis," Sarah said. "Hell, we've got acidophilous bacteria living in us right now that help us digest our food. Lots more difference between them and us than between thermal bacteria and fireflies."

I put my foot on the pedal and prayed we wouldn't get stopped by some eager-beaver Pennsylvania trooper.

"That's the problem," Sarah continued. "Co-evolution, bio-mixing-and-matching, is a blessing and a curse. When everything's organic, and you cross-breed, you can get marvelous things. But you can also get flies that burn down buildings."

We finally got to Mo's house.

"Damn." There was no car in the driveway. And the door was half open.

"You wait in the car," I said to Sarah.

She started to protest.

"Look," I said. "We may be dealing with killers here—you've been saying that yourself. You'll only make it harder for me if you come along and I have to worry about protecting you."

"OK," she nodded.

I got out of the car.

Unfortunately, I didn't have my gun—truth is, I never used it anyway. I didn't like guns. Department had issued one to me when I'd first come to work for them, and I'd promptly put it away in my closet. Not the most brilliant move I'd ever made, given what was going on here now.

I walked into the house, as quietly as I could. I thought it better that I not announce myself—if Corinne and the kids were home, and I offended or frightened them by just barging in, there'd be time to apologize later.

I walked through the foyer and then the dining room that I'd never made it into to taste Corinne's great cooking yesterday. Then the kitchen and a hallway, and—

I saw a head, strawberry blonde, on the floor poking out of a bedroom.

Someone was on top of her.

"Laurie!" I shouted and dove in the room, shoving off the boy who was astride her.

"Wha—" he started to say, and I picked him up bodily, and threw him across the room. I didn't know whether to turn to Laurie or him—but I figured I couldn't do anything for Laurie with this kid at my back. I grabbed a sheet off the bed, rolled it tight, and went over to tie him up.

"Mister, I—" He sounded groggy, I guess from hitting the wall.

"Shut up," I said, "and be glad I don't shoot you."

"But I—"

"I said shut up." I tied him as tightly as I could. Then I dragged him over to the same side of the room as Laurie, so I could keep an eye on him while I tended to her.

"Laurie," I said softly, and touched her face with my hand. She gave no response. She was out cold on some-

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thing—I peeled back her eyelid, and saw a light blue eye floating, dilated, drugged out on who knew what.

"What the hell did you do to her? Where's her mother and sister?" I bellowed.

"I don't know—I mean, I don't know where they are," the kid said. "I didn't do anything to her. But I can help her."

"Sure you can," I said. "You'll excuse me if I go call an ambulance."

"No, please, Mister, don't do that!" the kid said. His voice sounded familiar. Amos Stoltzfus!

"She'll die before she gets to the hospital," he said. "But I have something here that can save her."

"Like you saved your father?" I asked.

There were tears in the kid's eyes. "I got there too late for my father. How did you know my—oh, I see, you're the friend of Mo Buhler's I was talking to this morning."

I ignored him and started walking out of the room.

"Please. I care about Laurie too. We're—we've been seeing each other—"

I turned around and picked him up off the floor. "Yeah? That's so? And how do I know you didn't somehow do this to her?"

"There's a medicine in my pocket. It's a tomato variant. Please—I'll drink half of it down to show you it's OK, then you give the rest to Laurie—we don't have much time."

I considered for a moment. I looked at Laurie. I guess I didn't have anything to lose having the kid drink half of whatever he was talking about. "OK," I said. "Which pocket?"

He gestured to his left front jeans.

I pulled out a small vial—likely contained only five to six ounces.

"You sure you want to do this?" I asked. I suddenly had a queasy feeling—I didn't want to be the vehicle of some sick patricidal kid's suicide.

"I don't care whether you give it to me or not," Amos said. "Just give some to Laurie already! Please!"

I have to make gut decisions all the time in my line of work. Only usually not about families I deeply care about. I thought for another second, and decided.

I bypassed his taking the sample, and went over to Laurie. I hated to give her any liquid when she was still unconscious—

"It's absorbed on the back of the tongue," Amos said. "It works quick."

God, I hoped this kid was right—I'd kill him with my bare hands if this wasn't right for Laurie. I put an ounce or two on her tongue. A few seconds went by. More. Maybe thirty seconds, forty . . . "Goddamnit, how exactly long does this—"

She moaned, as if on cue. "Laurie?" I asked, and patted her face.

"Mmm . . ." she opened her eyes. And smiled! "Phil?"

"Yeah, honey, everything's OK," I said.

"Laurie!" Amos called out from across the room.

Laurie got up. "Amos? What are you doing here? Why are you tied up like that?"

She looked at him and then me like we were both crazy.

"Long story, never mind," I said, and went over to untie Amos. I found

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myself grinning at him. "Good for you; you were right, kid," I said.

He smiled back.

"Where are your mom and Emma?" I asked.

"Oh," Laurie suddenly looked sadder than I'd ever seen her. "They went over to the funeral home this morning, that's where Dad is, to make arrangements. They took your car, Mom found the keys for it in your bag." And she started crying.

Amos put his arms around her, comforting her.

"You have any idea what happened to you? I mean, after your Mom and sister left?" I asked gently.

"Well," she said, "some nice lady was coming around selling stuff—you know, soaps, perfumes, and little household things—like Avon, but some company I never heard of. And she asked me if I wanted to smell some new perfume—and it smelled wonderful, like a combination of lilacs and the ocean, and then . . . I don't know, I guess you were calling me, and I saw Amos tied up and . . . what happened? Did I pass out?"

"Well—" I started.

"Uhm, Mr., uh, Phil—" Amos interrupted.

"It's Dr. D'Amato, but my friends call me Phil, and you've earned that right," I said.

"OK, thanks, Dr. D'Amato—sorry, I mean Phil—but I don't think we should hang around here. These people—"

"What do you mean?" I said.

"I'm saying I don't like what the light looks like in this house. They killed my father, they tried to poison Laurie, who knows what they might have planted—"

"OK, I see your point," I said, and saw again the Stoltzfus farm—Amos's farm—ashes in the dirt.

I looked at Laurie. "I'm fine," she said. "But why do we have to leave?"

"Let's just go," I said, and Amos and I ushered her out.

The first thing I noticed when we were out of the house was that Sarah and my car—Mo's car—were gone.

The second thing I noticed was a scorching heat on the back of my neck. I rushed Laurie and Amos across the street, and turned back to look at the house.

Intense blue-white flames were sticking their searing tongues out of every window, licking the roof and the walls and now the garden with colors I'd never seen before.

Laurie cried out in horror. Amos held her close. "Fireflies," he muttered.

The house burned to the ground in minutes.

We stood mute, in hot/cold shivering shock, for what felt like a long, long time.

I finally realized I was breathing hard. I thought about allergic reactions. I thought about Sarah.

"They must've taken Sarah," I said.

"Sarah?" Amos asked, holding Laurie tight in a clearly loving way. She was sobbing.

"Sarah Fischer," I said.

Laurie and Amos both nodded.

"She was a friend of my father's," Laurie said.

"She's my sister," Amos said.

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"What?" I turned to Amos. Laurie pulled away and looked at him too. He had a peculiar, almost tortured sneer on his face, mixture of hatred and heartbreak.

"She left our home more than ten years ago," Amos said. "I was still just a little boy. She said she could no longer be bound by the ways of our *Ordnung*—she said it was like agreeing to be mentally retarded for the rest of your life. So she left to go to some school. And I think she's been working with those people—those people who killed my father and burned Laurie's house."

I suddenly tasted the grapes in my mouth from last night, sweet taste with choking smoke, and I felt sick to my stomach. I swallowed, took a deliberate deep breath.

"Look," I said. "I'm still not clear what's really going on here. I find Laurie unconscious—you, someone, could've put a drug in her orange juice for all I know. The house just burned down—could've been arson with rags and lighter fluid, just like we have back in New York City." Though I knew I'd never seen a fire quite like that.

Laurie stared at me like I was nuts.

"They were fireflies, Mr. D'A—Phil," Amos said. "Fireflies caused the fire."

"How could they do that so quickly?"

"They can be bred that way," Amos said. "So that an hour or a day or week after they start flying around, they suddenly heat up to cause the fire. It's what you *scientists*," he said with ill-concealed derision, "call setting a genetical switch. Mendelian lamps set to go off like clockwork and burn—Mendel bombs."

"Mendel bombs?"

"Wasn't he a genetical scientist? Worked with peas? Insects are simple like that too—easy to breed."

"Yeah, Gregor Mendel," I said. "You're saying Sarah—your sister—was involved in this?"

He nodded.

I thought about the lamp on Sarah's floor.

"Look, Amos, I'm sorry about before—I don't really think you did anything to Laurie. It's just—can you show me any actual *evidence* of this stuff? I mean, like, the fireflies *before* they burn down a house?"

Amos considered. "Yeah, I can take you to a barn—it's about five miles from here."

I looked at Laurie.

"The Lapp farm?" she asked.

Amos nodded.

"It's OK," she said to me. "It's safe. I've been there."

"All right, then," I said. But Mo's car—and my car—were still gone. "How are we going to get there?"

"I parked my buggy at my friend's—about a quarter of a mile from here," Amos said.

Clop, clop, clop, looking at a horse's behind, feeling like one—based on what I was able to make sense of in this case. Horses, flames, mysterious deaths—all the ingredients of a Jack Finney novel set in the nineteenth century. Except this was the end of the twentieth. And so far all I'd done is manage to get dragged along to

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every awful event. Well, at least I'd managed to save Laurie—or let Amos save her. But I had to do more—I had to stop just witnessing and reacting, and instead get on top of things. I represented twentieth-century science, for godsake. OK, it wasn't perfect, it wasn't all-powerful. But surely it had taught me enough to enable me to do *something* to counter these bombs and allergens, these . . . Mendelian things.

I'd also managed to get through to Corinne at the funeral home, from a pay phone on a corner, before we'd gotten into Amos's buggy. I'd half expected his horse and buggy to come with a car phone—a horse phone?—that was how crazy this "genetical" stuff was getting me. On the other hand, I guess the Amish could have rigged up a buggy with a cellular phone running on battery at that. Well, at least I was learning. . . .

"We should be there in a few minutes." Amos leaned back from the driver's seat, where he held the reins and clucked the lone horse along. He—Amos had told me the horse was a he—was a dark brown beautiful animal, at least to my innocent city eyes. The whole scene, riding along in a horse and buggy on a bright crisp autumn day, was astonishing—because it wasn't a buggy ride for a tourist's five dollar bill, it was real life.

"You know, I ate some of your sister's food," I blurted out the qualm that occurred to me again. "You don't think, I mean, that maybe it had a slow-acting allergen—"

"We'll give you a swig of an antidote—it's pretty universal—when we get to John Lapp's, don't worry," Amos leaned back and advised.

"Sarah, your sister, was telling me something about some low-grade allergen let loose on our population after World War II. Didn't kill anyone, but made most people more irritable than they'd been before. Come to think of it, I suppose it indeed could have been responsible for lots of deaths, when you take into account the manslaughters that result from people on edge, arguments gone out of control."

"You're talking the way Poppa used to," Laurie said.

"Your dad talked about those allergens?" I asked.

"No," Laurie said. "I mean he was always going on about manslaughter, and how it had just one or two little differences in spelling from man's laughter, and how those differences made all the difference."

"Yeah, that was Mo all right," I said.

"That's John Lapp's farm up ahead," Amos said.

The meadow was green, still lush in this autumn. It was bounded by fences that looked both old, and, implausibly, in very good condition. Like we'd been literally traveling back in time.

"So, Amos, your opinion on your sister's idea about the allergens?" I prompted.

"I don't know," he said. "That was my sister's area of study."

A barn, a big barn, but no different on the outside than hundreds of other barns in the countrysides of Pennsylvania and Ohio. How many of them

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had what this one had inside?

Variations of Sarah's words played in my ears. Why do we expect science to always come in high-tech wrappings? Darwin was a great scientist, wasn't he, and just the plain outside world was his laboratory. Mendel came upon the workings of genetics by cultivating purple and white flowering peas in his garden. Was a garden so different from a barn? If anything, it was even lower-tech.

A soft pervasive light embraced us as we walked inside—keener than fluorescent, more diffuse than incandescent, a cross between sepiatone and starlight maybe, but impossible to describe with any real precision if you hadn't actually seen it, felt its photons slide through your pupils like pieces of a breeze.

"Fireflight," Amos whispered, though I had realized that already. I'd seen fireflies before, loved them as a boy, poured over Audubon guides to insects with pictures of their light, but never anything like this.

"We have lots of uses for insects, more than just light," Amos said, and he guided me over, Laurie on his arm, to a series of wooden contraptions all entwined with nets. I looked closer, and saw swarms of insects—bees mostly, maybe other kinds—each in its own gauzed compartment. There were several sections with spiders too.

"These are our nets, Phil," Amos said. "The nets and webs of our information highway. Our insects are of course far slower and smaller in numbers than your electrons, but far more intelligent and motivated than those non-living things that convey information on yours. True, our communicators can't possibly match the pace and reach of the broadcast towers, the telephone lines, the computers all over your world. But we don't want that. We don't need the speed, the high blood pressure, the invasion of privacy, that your electrons breed. We don't want the numbers, the repetition, all the clutter. Our carriers get it right, for the jobs that we think are important, the first time."

"Well they certainly get it just as deadly," I said, "at least when it comes to burning down houses. Nature strikes back." And I marveled again at the wisdom of these people, this boy—which, though I disagreed about the advantages of bug-tech over electricity, bespoke a grasp of information theory that would do any telecom specialist proud—

"Nature was never really gone, Dr. D'Amato," a deep voice that sounded familiar said.

I turned around. "Isaac . . ."

"I apologize for the deception, but my name is John Lapp. I pretended to be Jacob's brother at his farm because I couldn't be sure that you weren't videotaping me with some kind of concealed camera. The two of us are roughly the same age and height, so I took the chance. You'll forgive me, but we have great distrust for your instruments." His face and voice were "Isaac Stoltzfus's," all right, but his delivery was vastly more commanding and urbane.

I noticed in the corner of my eye that Laurie's were wide with awe. "Mr. Lapp," she stammered, "I'm very honored to meet you. I mean, I've

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been here before with Amos," she squeezed his hand, "but I never expected to actually meet you—"

"Well, I'm honored too, young lady," Lapp said, "and I'm very very sorry about your father. I only met him once—when I was first pretending to be Isaac the other day—but I know from Jacob that your father was a good man."

"Thank you," Laurie said, softly.

"I have something for you, Laurie Buhler." Lapp reached into his long, dark coat and pulled out what looked like a lady's handbag, constructed of a very attractive moss-green woven cloth. "Jacob Stoltzfus designed this. We call it a lamp-case. It's a weave of special plant fibers dyed in an extract from the glow-worm, with certain chemicals from luminescent mushrooms mixed into the dye to give the light staying power. It glows in the dark. It should last for several months, as long as the weather doesn't get too hot. Then you can get a new one. From now on, if you're out shopping after the Sun sets, you'll be able to see what you have in your case, how much money you have left, wherever you are. From what I know of young lady's purses—I have three teenaged daughters—this can be very helpful. Some of you seem to be lugging half the world around with you in there!"

Laurie took the case, and beamed. "Thank you so much," she said. She looked at me. "This is what Poppa was going to get for me the other night. He thought I didn't know—he wanted to pick this purse up, at Jacob Stoltzfus's farm, and surprise me for my birthday tomorrow. But I knew." And her voice cracked and tears welled in her eyes.

Amos put his arms around her again, and I patted her hair.

"Mo would've wanted to get to the bottom of this," I said to Lapp. "What can you tell me about who killed him—and Amos's father?"

He regarded me, without much emotion. "The world is changing before your very eyes, Dr. D'Amato. Twelve-hundred-pound moose walk down the main street in Brattleboro, Vermont. People shoot 400-pound bears in the suburbs of New Hampshire—"

"New Hampshire is hardly a suburb, and Mo wasn't killed by a bear—he died right next to me in my car," I said.

"Same difference, Doctor. Animals are getting brazen, bacteria are going wild, allergies are rampant—it's all part of the same picture. It's no accident."

"Your people are doing this, deliberately?" I asked.

"My people?—no, I assure you, we don't believe in aggression. These things you see here"—he waved his hand around the barn, at all sorts of plants and small animals and insects I wanted to get a closer look at—"are only to make our lives better, in quiet ways. Like Laurie's handbag."

"Like the fireflies that burn down buildings?" I asked.

"Ah, we come full circle—this is where I came in. Alas, we unfortunately are not the only people on this Earth who understand more of the power of nature than is admitted by your technological world. You have plastics, used for good. You also have

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plastic used for evil—you have semtex, that blows your airplane from the sky. We have bred fireflies for good purposes, for light and moderate heat, as you see right here." He pointed to a corner of the barn, near where we were standing. A fountain of the sepiatone and starlight seemed to emanate from it. I looked more carefully, and saw the fountain was really a myriad of tiny fireflies—a large Mendelian lamp. "We mix slightly different species in the swarm," Lapp continued, "carefully chosen so that their flashings overlap to give a continuous, long-lasting light. The mesh is so smooth that you can't see the insects themselves, unless you examine the light very closely. But there are those who have furthered this breeding for bad purposes, as you found out in both the Stoltzfus and Buhler homes."

"Well, if you know who these people are, tell me, and I'll see to it that they're put out of business," I said.

For the first time, I noticed a smear of contempt on John Lapp's face. "Your police will put them out of business? How? In the same way you've put your industrial Mafia out of business? In the same way you've stopped the drug trade from South America? In the same way your United Nations, your NATO, all of your wonderful political organizations have ended wars in the Middle East, in Europe, in Southeast Asia all these years? No thank you, Doctor. These people who misuse the power of nature are *our* problem—they're not our people any longer but they come originally from our people—and we'll handle them in our own way."

"But two people are dead—" I protested.

"You perhaps will be too," Amos said. He proffered a bottle with some kind of reddish, tomatoey-looking liquid. "Here, drink this, just in case my sister gave you some slow-acting poison."

"A brother and a sister," I said. "Each tells me the other's the bad guy. Classic dilemma—for all I know this is the poison."

Lapp shook his head. "Sarah Stoltzfus Fischer is definitely bad," he said solemnly. "I once thought I saw some good that could be rekindled in her, but now . . . Jacob told Mo Buhler about her—"

"Her name was on Mo's car phone list," I said.

"Yes, as someone Mo was likely investigating," Lapp said. "I told Jacob he was wrong to tell Mo so much. But Jacob was stubborn—and he was an optimist. A dangerous combination. I'm sorry to say this," he looked with hurt eyes at Laurie, "but Mo Buhler may have brought this upon Jacob and himself because of his contacts with Sarah."

"If Poppa believed in her, then that's because he still saw some good in her," Laurie insisted.

John Lapp shook his head, sadly.

"And I guess I made things worse by contacting her, spending the night with her—" I started saying.

All three gave me a look.

"—*Alone,* on the couch," I finished.

"Yes, perhaps you did make things worse," Lapp said. "Your style of investigation—Mo Buhler's—can't do any good here. These people will

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have you running around chasing your own tail. They'll taunt you with vague suggestions of possibilities of what they're up to—what they've been doing. They'll give you just enough taste of truth to keep you interested. But when you look for proof, you'll find you won't know which end is up."

Which was a pretty good capsule summary of what I'd been feeling.

"They introduced long-term allergen catalysts into our bloodstreams, our biosphere, years ago," Lapp went on. "Everyone in this area has it. And once you do, you're a sitting duck. When they want to kill you, they give you another catalyst, short-term, any one of a number of handy biological agents, and you're dead within hours of a massive allergic attack to some innocent thing in your environment. So the two catalysts work together to kill you. Of course, neither one on its own is dangerous, shows up as suspicious on your blood tests, so that's how they get away with it. And no one even notices the final innocent insult—no one is ordinarily allergic to an autumn leaf from a particular type of tree against your skin, or a certain kind of beetle on your finger. That's why we developed the antidote to the first catalyst—it's the only way we know of breaking the allergic cycle."

"Please, Phil, drink this." Amos pushed the bottle on me again.

"Any side effects I should know about? Like I'll be dead of an allergic attack in a few hours?"

"You'll probably feel a little more irritable than usual for the next week," Lapp said.

I sighed. "What else is new."

Decisions . . . even if I had the first catalyst, I could live the rest of my life without ever encountering the second. No, I couldn't go on being so vulnerable like that. I liked autumn leaves. But how did I know for sure that what Amos was offering me was the antidote, and not the second catalyst? I didn't—not for sure—but wouldn't Amos have tried to leave me in Mo's house to burn if he'd wanted me dead? Decisions . . .

I drank it down, and looked around the barn. Incredible scene of high Victorian science, like a nineteenth-century trade card I'd once seen for an apothecary. Enough to make my head spin. Then I realized it *was* spinning—was this some sort of reaction to the antidote? Jeez, or was the antidote the poison after all? No—the room wasn't so much spinning, as the light, the fireflight, was flickering . . . in an oddly familiar way.

Lapp was suddenly talking, fast, arguing with someone.

Sarah!

"There's a Mendel bomb here," she was shouting. "Please. You all have to leave."

Lapp looked desperately around the room, back at Sarah, and finally nodded. "She's right," he said and caught my eye. "We all have to leave now." He grabbed on to Sarah's shoulder, and beckoned me to follow.

Amos had his arm around Laurie, and was already walking quickly with her towards the door. Everyone else was scurrying around, grabbing what netted cages they could.

"No," I said. "Wait." An insight was

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just nibbling its way into my mind.

"Doctor, please," Lapp said. "We have to leave now."

"No, you don't," I said. "I know how to stop the bomb."

Lapp shook his head firmly. "I assure you, we know of no remedy to stop this. We have perhaps seven, maybe eight minutes at most. We can rebuild the barn. Human lives we cannot rebuild."

Sarah looked at me with pleading eyes.

"No," I insisted, looking past Sarah at Lapp. "You can't just keep running like this from your enemies, letting them burn you out. You have incredible work going on here. I can stop the bomb."

Lapp stared at me.

"OK, how's this?" I said. "You clear out of here with your friends. No problem. I'll take care of this with *my* science and then we'll talk about it, all right? But let me get on with it already."

Lapp signaled the last of his people to leave. "Take her," he said, and passed custody of Sarah along to a big burly man with a grey-flecked beard. She tried to resist but was no match for him.

Lapp squinted at the flickering fireflies. They were much more distinct now, as if the metamorphosis into bomb mode had coarsened the nature of the mesh.

He turned to me. "I'll stay here with you. I'll give you two minutes and then I'm yanking you out of here. What does your science have to offer?"

"Nothing all that advanced," I said, and pulled my little halogen flashlight out of my pocket. "Those are fireflies, right? If they've retained anything of the characteristics of the family *Lampyridae* I know about, then they make their light only in the absence of daylight, when the day has waned—they're nocturnal. During the day, bathed in daylight, they're just like any other damn beetle. Well, this should make the necessary adjustment." I turned up the flashlight to its fullest daylight setting, and shone it straight at the center of the swirling starlight fountain, which now had a much harsher tone, like an ugly light over an autopsy table. I focused my halogen on the souped-up fireflies for a minute and longer. Nothing happened. The swirling continued. The harsh part of their light got stronger.

"Doctor, we can't stay here any longer," Lapp said.

I sighed, closed my eyes, and opened them. The halogen flashlight should have worked—it should have put out the light of least some of the fireflies, then more, disrupting their syncopated overlapping pattern of flashing. I stared hard at the fountain. My eyes were tired. I couldn't see the flies as clearly as I could a few moments ago. . . .

No . . . of course!

I couldn't see as clearly because the light was getting dimmer!

There was no doubt about it now. The whole barn seemed to be flickering in and out, the continuous light effect had broken down, and each time the light came back, it did so a little more weakly. . . . I kept my halogen trained on the flies. It was soon the only light in the barn.

Lapp's hand was on my shoulder.

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"We're in your debt, Doctor. I almost made the fool's mistake of closing my mind to a source of knowledge I didn't understand—a fool's mistake, as I say, because if I don't understand it, then how can I know it's not valuable?"

"Plato's Meno Paradox strikes again," I said.

"What?"

"You need some knowledge to recognize knowledge, so where does the first knowledge come from?" I smiled. "Wisdom from an old Western-style philosopher—I frequently consult him—though actually he probably had more in common with you."

Lapp nodded. "Thank you for giving us this knowledge of the firefly, that we knew all along ourselves but didn't realize. From now on, the Mendel bombs won't be such a threat to us—once we notice their special flicker, all we'll need to do is flood the area with daylight. Plain daylight. Sometimes we won't even need your flashlight to do it—daylight is after all just out there, naturally for the asking, a good deal of the time."

"And in the evenings, you can use the flashlight—it's battery operated, no strings attached to central electric companies," I said. "See, I've picked up a few things about your culture after all."

Lapp smiled. "I believe you have, Doctor. And I believe we'll be all right now."

"Yeah, but it was a good thing you had Sarah Fischer to warn you this time, anyway," I said.

Of course, the enemies of John Lapp and Amos Stoltzfus would no doubt come up with other diabolical breedings of weapons. No one ever gets a clear-cut complete victory in these things. But at least the scourge of Mendel bombs would be reduced. I guess I'd given them an SDI for these pyro-fireflies—imperfect, no doubt, but certainly a lot better than nothing.

I was glad, too, about how Sarah Fischer had turned around. She'd come back to the barn to warn us. Said she couldn't take the killing anymore. She said she had nothing directly to do with Mo's or Jacob's—her father's—deaths, but she could no longer be part of a community that did such things. She had started telling me about the allergens—the irritation ones—because she wanted the world to know. I wanted to believe her.

I'd thought of calling the Pennsylvania police, having them take her into custody, but what was the point? I had no evidence on her whatsoever. Even if she had set the Mendel bomb in John Lapp's barn—which I didn't believe—what could I do about that anyway? Have her arrested for setting a bomb made of incendiary flies I'd been able to defuse by shining my flashlight—a bomb that Lapp's people were unwilling in any way to even acknowledge to the outside world, let alone testify about in court? No thank you—I've been laughed out of court enough times as is already.

And Lapp said his people had some sort of humane program for people like Sarah—help her find her own people and roots again. She needed that. She was a woman without community

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now, shunned by all parties. The worst thing that could happen to someone of Sarah's upbringing. It was good that John Lapp and Amos Stoltzfus were willing to give her a second chance—offer her a lamp of hope, maybe the real meaning of the Mendelian lamp, as Lapp had aptly put it.

I rolled my window down to pay the George Washington Bridge toll. It felt good to finally be back in my own beat-up car again, I had to admit. Corinne was off with the girls to resettle in California. I'd said a few words about Mo at his funeral, and now his little family was safely on a plane out West. I couldn't say I'd brought his murderers to justice, but at least I'd put a little crimp in their operation. Laurie had kissed Amos good-bye, and promised she'd come back and see him, certainly for Christmas. . . .

"Thanks, Chief." I took the receipt and the change. I felt so good to be back I almost told him to keep the change. I left the window rolled down. The air had its customary musky aroma—the belches of industry, the exhaust fumes of even EPA-clean cars still leaving their olfactory mark. Damn, and didn't it feel good to breathe it in. Better than the sweet air of Pennsylvania, and all the hidden allergens and catalysts it might be carrying. It had killed both Jacob and Mo. They'd been primed with a slow-acting catalyst years ago. Then the second catalyst had been introduced, and whoosh . . . some inconsequential something in their surroundings had set the last short fuse. Just as likely a stray firefly of a certain type that buzzed at their ankles, or landed on their arm, as anything else. Jacob's barn had been lit by them. The lamp was likely the other thing Mo had wanted to show me. There were likely one or two fireflies that had gotten into our car on the farm, and danced unseen around our feet as we drove to Philadelphia that evening. . . . A beetle for me, an assassin for Mo.

The virtue of New York, some pundit on the police force once had said, is that you can usually see your killers coming. Give me the soot and pollution, the crush of too many people and cars in a hurry, even the mugger on the street. I'll take my chances.

I unconsciously slipped my wallet out of my pocket. This thinking about muggers must have made me nervous about my money. It was a fine wallet—made from that same special lamp-weave as Laurie's handbag. John Lapp had given it to me as a little present—to remember Jacob's work by. For a few months, at least, I'd be able to better see how much money I was spending.

Well, it was good to have a bit more light in the world—even if it, like the contents it illuminated, was ever-fleeting. . . . ■

EDITOR'S NOTE: Earlier tales of Phil D'Amato include "The Chronology Protection Case" (September 1995) and "The Copyright Notice Case" (April 1996).

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THE REFERENCE LIBRARY Tom Easton

Corrupting Dr. Nice, John Kessel, TOR, $24.95, 317 pp. (ISBN: 0-312-86116-8).
Beggars Ride, Nancy Kress, TOR, $23.95, 303 pp. (ISBN: 0-312-44554-6).
Night Sky Mine, Melissa Scott, TOR, $24.95, 384 pp. (ISBN: 0-312-85875-2).
Cosmic Thunder, William John Watkins, Avon, $5.99, 247 pp. (ISBN: 0-380-78203-0).
Night Lamp, Jack Vance, TOR, $23.95, 380 pp. (ISBN: 0-312-85685-7).
All-American Alien Boy, Allen Steele, Old Earth Books (P. O. Box 19951, Baltimore, MD 21211-0951), $15 tp (call about 100-copy signed ltd. ed.), 208 pp. (ISBN: 1-882968-06-9).
The Silence of the Langford, Dave Langford, NESFA Press (P. O. Box 809, Framingham, MA 01701-0203), $15, 278 pp. (ISBN: 0-915368-62-5).
Visions of Wonder, David G. Hartwell and Milton T. Wolf, eds., TOR, $24.95, 798 pp. (ISBN: 0-312-85287-8).

Encounter with Tiber, Buzz Aldrin and John Barnes, Aspect (part of Time Warner) $21.95, 560 pp. (ISBN: 0-446-518854-9). *Reviewed by Peter L. Manly.*

NOTABLE REISSUES

The Once and Future King, T. H. White, Ace, $16.95, 677 pp. (ISBN: 0-441-00383-4).
All Judgment Fled, James White, Old Earth Books (P. O. Box 19951, Baltimore, MD 21211-0951), $15, 190 pp. (ISBN: 1-882968-07-7).
The Watch Below, James White, Old Earth Books (P. O. Box 19951, Baltimore, MD 21211-0951), $15, 192 pp. (ISBN: 1-882968-08-5).

It's been a while since the last time I had a chance to praise John Kessel's talent for "satire with fangs" (*Good News from Outer Space,* 1990). I am delighted to tell you of the fun you will have reading **Corrupting Dr. Nice**. It's a grand romp through the moment universes by two lovers who quite refuse to understand each other, and ...

What's a "moment universe" or MU, you ask? Kessel tells us that time is quantized, and each moment in time (137.04 per second) is an entire universe all by itself. Time travelers can thus monkey around to their hearts' content without having to worry about changing their present. All ramifications are neatly and safely self-contained. And the tourist industry is

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booming—quite literally, for now there can be "extreme tours" that let you try to massacre the Spaniards with automatic weapons just before they cream the Incas, and thus change at least one MU's history. So is the market for modern gimcracks and gewgaws, while the oil companies are pumping all the petro they want from all those MUs that haven't yet discovered the treasures in their ground.

There are other sorts of opportunities as well. Meet Genevieve Faison and her dear papa August, playing the badger game in an eighteenth-century France and fleeing with the boodle to a Jerusalem just as paleontologist Dr. Owen Vannice ("Dr. Nice" himself) stumbles in from the Cretaceous with Wilma, a young dinosaur in a travel box. Owen is a clumsy innocent, an ideal mark in August's eyes, and wouldn't it be nifty to snaffle the diny. Jen thinks he's cute, and pretty soon, she and Owen are stuck on each other. Unfortunately, soon after that, Owen finds out she's a crook, refuses to listen, and spurns her. She gets just as huffy and vows revenge. He pines. She ...

Meanwhile, the "historicals" (natives of the time) are restless. The Roman tyrants have been displaced by time travelers, but the new overlords are far too obtrusive and influential. The Apostle Simon (the Zealot) is a flunky in the hotel, Jesus—several Jesuses, actually—having been taken uptime for the talk-show circuit. His son has been corrupted by the future. And Simon's buddies are gathering weapons for a rebellion.

You can see where the plot is going, and go there it does at quite a jaunty trot. But there's meat on the situation-comedy bones: Kessel is concerned with humans' tendency to horn in on each other. Owen's mother is a media biggie who sees everything—Wilma, the hostage crisis, the wedding—as a photo op. August wants the boodle. The tourists want thrills, and the rights of the locals be damned. Modern commerce likewise. And the "protect the past" folks think Owen is a villainous exploiter.

Or do they, really? After all, Gen is working for them at one point, and her boss, Lance Thrillkiller, sounds like it's all just another scam designed to pry the boodle from the marks.

If there is a flaw here, it is that Kessel has his hands on quite a complex situation and refuses to simplify it enough to make it look simple. Exploitation is not all bad, and if time is indeed quantized as he says, then human culture could indeed grow to be a very inclusive thing indeed, with terrorists from 41 CE being tried in 2063. The question of who owns local resources then becomes an extension of the same question confronted by indigenous peoples here and now, and it has—expectably—no more satisfying an answer.

We might also ask whether Kessel has truly thought his scheme through. Once an MU has been altered by intervention, it presumably goes on to develop a history all its own, full of moments. Is *its* time quantized, too? That is, are there nested quanta here? Can the indivisible be divided? If so, this is the sort of contradiction mathematicians routinely use to blow a notion all to shreds. And what happens

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when a looted MU's future time travelers show up, wanting to know who ripped off their oil, etc.?

Perhaps he *did* simplify things a bit, after all.

It should by now be clear to all that Nancy Kress is a dominant figure in modern science fiction. If it isn't, her thoughtful, thought-provoking Beggars series should settle the issue.

Kress has for some time been deeply concerned with the way we accept new technologies. Last year's *Oaths and Miracles* provided a nice example, as did *Beggars in Spain* (which won both Hugo and Nebula in its 1991 novella version) and *Beggars & Choosers* (1995). **Beggars Ride** completes the Beggars trilogy. The technology in question is genetic engineering. Kress's tale begins when it is used to create the Sleepless: highly intelligent, eminently sane, generally joyful, potentially immortal, and immune to sleep. The immediate reaction of the unimproved Sleepers is envy, jealousy, and persecution. The Sleepless struggle to make themselves safe, eventually creating an ultimate welfare state where genetically modified "donkeys" are the ones who work and create, while the unmodified "livers" bask in the sun. Super-Sleepless, engineered by the Sleepless, then find a way to give the Sleepers a certain amount of independence by making them able to survive on Sun and soil alone, like plants (behold the lilies of the field, which toil not).

Yet this is not a utopia, for it is a rigidly stratified society which denies bright livers such as Lizzie the chance they crave to learn and achieve. And when the gifts of the Super-Sleepless—the Change syringes with which each newborn, Sleeper or Sleepless, must be injected if it is to have a place in the Sun and be immune to disease—are not renewed, the situation begins to turn a bit desperate.

Now Jennifer Sharifi, Sleepless rebel, is out of prison, reclaiming Sanctuary in orbit and plotting to ensure that her people will forever be safe from persecution. Doctor Jackson Aranow, mostly useless since the Change, is tending Teresa, a sister who has refused to be Changed, who quails at any thought of novelty. Lizzie has a baby and wonders what will become of her child in a world without Change syringes.

We soon learn the nature of Jennifer's scheme: a virus that will make permanent changes in human brains. Something happens at Lizzie's liver camp, and the livers there turn timid, as fearful of novelty as Teresa; their lives are naught but repetitive routine now, and they are quite incapable of threatening the Sleepless. Aranow meets Lizzie and his sympathies are aroused, but he feels largely helpless as the plague spreads, his pharmaceutical-company contacts see in the new affliction less need of cure than hints of novel drugs and vast wealth, and disaster develops all around him. It is Teresa who is the hope of the world, for she is learning that external change may have its uses, but the most useful change comes from within, and it can reach very deep indeed, even into the very workings of the brain.

At the end of the novel—and let me try to put this in such a way that I do

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not spoil it for you—Kress answers the conundrum with which she began the series: What do beggars give that is worth the alms they ask? Need, she tells us, to which we respond in ways that strengthen us. Yet perhaps she does not quite trust such a fuzzy-warm-feel-good answer herself, for she then tells us that though the sources of external change in her world have been dramatically destroyed, that world has a chance to reclaim them. Will it do so? Or will it go with the fuzzy-warm wonders of need? She leaves the question open.

Don't miss this one, or Kress's next.

Melissa Scott has done some very interesting things in her latest, **Night Sky Mine**. The future in which she is playing is marked by a civilization whose corporate, labor, and government sectors have become virtual nation-states in their own right. Each is dominated by certain families, as are the gypsy-like Travelers, but there is a certain amount of movement between them, driven by choice and circumstance.

The title refers to the Night Sky Mine Company, which owns a stellar system where something strange is going on. Mining stations, searching for minerals among the system's asteroid belts, are being attacked, their inhabitants slaughtered, their gear stripped. The Company seems to believe nothing serious is happening; the problem is just the general incompetence of the half-educated Union and Traveler miners.

But here's a crew, abandoning its station when a ship approaches and refuses to respond to hails, fleeing the Night Sky system for the Bestla system, where the local cops—represented by lovers Rangsey7 Justin (Union) and Tarasov Sein (Service)—investigate until preempted by higher authority from the Big City, the Centrality.

Now meet Kelly2/1 Ista. At age two, identity unknown and therefore a nonperson to the Company, the sole survivor of one of those mining-station raids, she was taken in by Kelly2 Jenna. Now her driving ambition is to acquire an official identity. Meanwhile, she is studying with Trindade, a Traveler hypothecary, learning to know and explore the Invisible World, where "artificial life" (a-life; self-reproducing computer programs) has created an ecosystem rich with raw material that can be harvested, hybridized, and tamed (programming as *we* know it is a long-lost art). Every hypothecary yearns to find new a-life-forms, newly mutated, newly evolved, for there lie wealth and new capabilities for civilization. Hypothecaries dread discovering the demogorgon, the precursor to artificial intelligence, which will promptly swamp the virtual world and make computer-based civilization quite, quite impossible. They—and the powers that be—also dread "wild," uncertified programs of all kinds, and a great deal of effort is devoted to keeping them at arm's length.

Not surprisingly, everything I have mentioned so far turns out to be connected. The Centrality cop sends Rangsey and Tarasov undercover to the Night Sky system. They promptly meet Ista, who immediately tells them of her past and decides that with a little help from a friend she can crack

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corporate databases and gain more information for them. She does so, spots a pattern, tells the cops, and with corporate security hot on her tail, they all light out for the mining station where she was found, which now seems to be the center of whatever mysterious shenanigans are going on.

Both the tale and its ending are very satisfying, despite a bit of idiot plotting (far too many people know of the mining-station attacks for the corporate cover-up to seem quite convincing). The characters are convincing, and though there is enough about their homosexuality to offend the moral redneck, Scott is not explicit; indeed, she deserves high praise for making them seem as normal as they really are.

Yet perhaps the very best aspect of *Night Sky Mine* is precisely what may appeal most to *Analog* readers: Scott has done wonders with the concept of artificial life, and she is astonishingly convincing.

William John Watkins's **Cosmic Thunder** plays interesting games with mystic hoo-hah. The setting is a future America where the economy is belly-up, and the landscape is infested with Smiling Zombies, zoned out on the ultimate euphoric, Dylastic Sugar, and a host of Nontraditional Theological Alternatives such as the Saltspeakers, who swear by a dumbed-down Bible and pound Salt into unbelievers. There are also the Sandscripti, ghostlike aliens who interact with our reality only via hieroglyphics scribbled on the air with light wands; intriguingly, the Sandscripti seem to want to teach people how to use the light wands so they can tell humanity something very important; unfortunately, the wands are unstable, with a tendency to incinerate clumsy users, and humans are clumsy.

Meet Theshei (once known as Naster Greatbridge), who dwells with the narrator in a cardboard box on the street until one day Theshei proposes they join the Saltspeakers for the sake of food and shelter, even though they know the Saltspeakers do not permit members to change their minds and quit. They do so, discovering a fairly typical brutalizing indoctrination, a neat fit for the narrator, and a misfit for Theshei, who makes a mortal enemy of the drill sergeant. In due time, Theshei jumps ship for the Sandscripti, the narrator follows, tasked to assassinate his oldest and best friend, and the two master the light wand and discover the Sandscripti's great secret.

It's not a very complex story, but it is one that must reassure anyone who—like the author, as he acknowledges in the book's dedication—has lost a loved one. Both the Salt and the Sandscripti embody the simple message that "Everything dances. Nothing lost. Nothing gained. Everything that goes remains. No good-byes. And nothing dies."

Jack Vance is back, as arch in tone and as inventive in nomenclature as ever, with **Night Lamp**. The tale is that of Jaro, a waif who one day finds a stranger torturing his mother, gives her mercy with a hatchet, and flees, only to be pounded into pulp by an

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urchin gang. Rescued by a pair of anthropologists, Hilyer and Althea Fath, he is taken to a clinic where, because he screams and thrashes so much, he is given a treatment that destroys his memory. Physically healed, he is then removed to the chi-chi world of Gallingale, where everyone who is *anyone* is obsessed with social climbing. The Faths are not; they are therefore "nimps," not-important social outcasts; so thereafter is Jaro.

Jaro nevertheless grows to maturity and competence and an obsession of his own, to learn the world of his origin and the secret of what happened to him. He will, he says, become a spaceman and go forth a-questing. Unfortunately, the Faths refuse to tell him what little they know—not even the name of the world on which they found him—until he has completed the education they have long envisioned for him.

Fortunately, in due time, events conspire to send Jaro off with friends and a spaceship. He backtracks successfully all the way to the star Night Lamp and a world of preciosity more decadent than that of the anti-nimps on Gallingale. They find corruption and conspiracy, and Jaro ends with all the truth he could ever have wished.

Alas, this précis makes the story sound more enchanting than it is. The Vancian flavor is here, all archness and color, as exotic as a guide book for Marrakech, but far too much of it is delivered as windy digressions that stop the reader quite cold.

Did he do that in years gone by? I don't think so. At least, a quick check of my index of books reviewed in the past shows that many of his older titles—which established his reputation—were considerably shorter. If *Night Lamp* were too, it would be a better book.

Old Earth Books is a pretty new label. The publisher is Michael J. Walsh, a familiar face to those who visit huckster rooms at cons as far from Baltimore as Boskone and Readercon, and he's getting his hands on some nice material and putting it out on acid-free paper for the collector market. So far most of the books are reissues (see below), but there is new as well. For instance, take a look at the **All-American Alien Boy** Allen Steele collection. Eleven stories, including three from *Analog* and *Asimov's* (remember "The Good Rat"?), one of them warning reviewers to be nice, all of them marked by Steele's journalist background (which I noted when I reviewed his previous Old Earth collection, *Rude Astronauts*) and accompanied by chatty little headnotes. The introduction tells us that Steele now lives in St. Louis instead of New England because he was getting out of touch with America; the stories say that he's fixed that, he's made contact, and he will surely have a great deal more to say over the next few years.

In the words of introducer Teresa Nielsen Hayden, Dave Langford is "a tall, deaf, extremely funny Welsh physicist and pyromaniac." He lives in England as a free-lance writer and is famous in fandom for the fanzine *Ansible*. In that forum and elsewhere he has for many years committed par-

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odies, commentaries, and book reviews stamped by a remarkably witty savagery that is only hinted at by such titles as "The Dragonhiker's Guide to Battlefield Covenant at Dune's Edge."

In 1992, NESFA published some of his material in a mimeographed chapbook, *Let's Hear It for the Deaf Man*. Now the same outfit offers us **The Silence of the Langford**. There's some overlap, but most of the book is newly collected. And it made me howl and snicker and snort, so I suspect it will you, too.

Especially if you enjoy book reviewers who first cosh their targets with lead-weighted baseball bats and then dance prolonged tarantellas on the corpses. The hatchet job done with manic verve, wit, and glee is a great deal of fun to commit as well as to read (except for the target), and I have been known on occasion to commit it (and to enjoy doing so). Perhaps very few books other than L. Ron Hubbard's final abominations really deserve such treatment, a thought that reins me in much more than it does Langford, but a witty hatchet job is still fun.

Visions of Wonder, edited by David G. Hartwell and Milton T. Wolf, is the third Science Fiction Research Association anthology. It is designed for use in the classroom, with both stories and essays, the latter mostly classics by Damon Knight, Hartwell, John W. Campbell, Judith Merrill, Algis Budrys, Samuel R. Delaney, Joanna Russ, and others.

Most of the stories are under a decade old, so it's hard to call them "classics." But the list is thoroughly imbued with something we might as well call "respectability," and it seems well designed to fulfill the editors' goal of showing SF as a living and lively literature busily blurring the genre boundaries and addressing important issues such as the human impact of new technologies, social problems, gender issues, and so on.

If you want to know more about the field, or if you wish a gift for someone who is just beginning to look at SF, or if you're a school librarian, grab it. If you teach modern SF, this is definitely a book to consider. However, if you want to teach the classics from the 1940s, 1950s, and 1960s, you will need to find another anthology—perhaps the earlier SFRA volumes.

The following review is by Peter L. Manly

In **Encounter With Tiber,** Buzz Aldrin has a story to tell. The second man to walk on the Moon has already told about space exploration in three previous nonfiction books but now he ventures into science fiction. Well-established co-author John Barnes kept Buzz honest in terms of plot development, characters, and story line. It is difficult at times to distinguish which parts which author wrote.

The tale is of Mankind's First Contact via SETI radios with an alien race—actually two intelligent races evolved on the same planet. The US has largely abandoned spaceflight and languishes in self-pity, welfare programs, and internal bickering. The text becomes a bit preachy at times but humanity does eventually head for the nearest star. Early spaceflight missions

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have their disasters, described in heart-stopping second-by-second detail. Of course, there's a Moonwalk sequence.

Since the book is intended for the general public, it contains lengthy technical explanations that SF fans might want to skip. Excellent illustrations showing orbits, spacecraft design, the aliens' planet and the aliens themselves, enhance the book. The politics of NASA make for a good set of side plots. Eventually the authors do get back to the main story.

The middle part of the book is a first-person narrative historical account of the aliens' first trip to Earth, many centuries ago. The authors have produced a fully mature and believable two-species society of aliens physiologically similar to humans but still exotic. The two alien species get along together—barely, allowing the authors to make their philosophical points about race, society and political history. The commentary is shown in terms of deeds and dialogue, well-written so that the book becomes a page-turner. The Earth and tragic first encounter with humans are seen through alien eyes. As a tale it has all the elements of adventure, political intrigue, violence, a little implied sex, some comedy, and one or two personal heroic victories.

Having shown the reader a First Contact example that didn't turn out well, the authors snap back to the near future of the next century where humanity gets to try its hand at encountering an alien society. Buzz is good at recounting the process of a spacecraft launch—the boring attention to details of checklists plus an occasional humorous or even randy comment from astronaut to mission controller. He also describes the tedium of spaceflight, spending long days essentially doing nothing but covering vast distances. The book also has a bit of romance—not the mushy kind found in cheap bodice-ripper paperbacks but the tender kind that even a football linebacker can appreciate.

With a cast of over seventy-five characters, the name index in the front of the book is handy. The story covers a millennium in time and several parsecs in space. As an epic novel it's a good read. Aldrin has done well on his first try.

NOTABLE REISSUES

One can trace many forms of literature to distinguished precedents. Epic poetry, for instance, reaches all the way back to Homer and beyond. In science fiction, major roots lie with Verne and Wells. For horror, look to Poe. A huge amount of modern fantasy can call J. R. R. Tolkien "Daddy," some of it legitimately. Much of the rest descends from the legend of Arthur, as first novelized in 1939 by T. H. White in the classic **The Once and Future King**.

Now this book is once more available outside the library. It's a reasonably priced trade paperback from Ace, and if you're a fan of Arthurian adventures, you owe it to yourself to see where they all started and just how corrupt the canon has grown. If you've read it before, then here's the perfect gift for that friend who thinks the movie came first.

In honor of James White's appear-

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ance as guest of honor at the 54th World Science Fiction Convention in 1996, Old Earth Books has just released a pair of early White novels, **All Judgment Fled** (1968) and **The Watch Below** (1966). White is best known today for his Sector General interstellar hospital stories, but he had written things before he began that grand series. *Judgment* relates the arrival in our solar system of a huge spacecraft and the journey by six humans in a primitive rocket to investigate. *Watch* is the story of a small group of people trapped in a sunken ship for generations, and their encounter with alien refugees who wish to settle in the sea. Both tales show clear kinships with White's later novels; they are therefore well worth attention despite their age.

Old Earth publisher Mike Walsh writes that beginning in 1997 he will be reissuing Doc Smith's Lensmen books as "trade paper facsimiles of the Fantasy Press hardcovers" priced at $15-17 each. Watch for them. ■

(Biolog continued from page 117)
sixteen. Appearances in SF fanzines and writing contests culminated five years later in a semi-prozine sale. A second appearance brought a nomination for a Nebula award, with reprints in Britain and Germany. Using old-time *Analog* writer Ted Cogswell's system of "digital enumeration," Wil would now have to count his published stories on all ten fingers and most of his toes.

Following the path blazed by Stanley Weinbaum, who revolutionized SF in 1954 with aliens who were truly alien, Wil has a special bent for ETs that are not simply dressed-up humans. Constructing a realistic alien or future human culture studded with sensible technologies also requires very serious thought about the limits of thermodynamics, workable economics, and raw materials availability. He cites Stan Schmidt's guidebook *Aliens and Alien Societies*. Gold will always be scarcer than carbon, but it is the combinative powers of carbon that will create the most valuable of all products: sentient beings.

Analog itself is an evolved creation exhibiting near-AI. Wil feels that *Analog*'s gimmicky, idea-driven stories are the proving ground for the rest of SF. Ideas are thrown into the ring to fight it out. The strongest memes are co-opted by the genre and then make a slow journey into popular culture. "*Analog* acts as the scientific and technological conscience for an entire civilization. *Analog*'s readers should be proud of their sustaining role in this process." ■

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BRASS TACKS

Dear Dr. Schmidt:

re: "No Blood on My Hands," August 1996 *Analog*, p. 57: "A very nasty virus . . . yes, yes, I'm on antibiotics."

Huh? Since when do antibiotics work against viruses?

LOUISE ELSEA

Oops!

Dear Stan:

In reference to your September editorial, "I/O": I agree that multiple-choice tests are excellent tools for determining knowledge—they determine how well you do on multiple-choice tests! For me, this ties directly into the Heisenberg Uncertainty Principle—that the act of observing something changes the thing that you're watching.

I've been told that I'm an excellent math tutor. I base most of my success on the fact that when I tutor, I refuse to tell the student anything (well, nearly). I believe in using my knowledge to find better questions to ask the students, and I've found that students get far more out of their time when they're encouraged to actually *"do"* it themselves.

I believe that part of the reason why "telling someone" something isn't effective, is because the input/output channels that one person has developed for thinking about a particular subject aren't going to be exactly the same for any two people.

As an example of how I personally form "channels" for thinking, I'd like to tell you about a counterpoint to your comment about computers, ". . . always amazed at how much harder it is to talk someone through it than to sit down at the keyboard and do it myself." I work in technical support for computers. All day long I talk on the telephone, explaining how to do this and that on computers. My company does not make house calls—all support is done over the phone. Well, one day I made an unofficial house call to fix a problem, and when I sat down at the keyboard I drew a blank, until I started talking to myself, "OK, Bill, what do you see on your screen?" My knowledge was partially a function of the habits I use to access it.

So, thanks for the editorial. I hope that everyone who is thinking of testing/interviewing anyone bears in mind that explaining something doesn't necessarily correlate directly into being able to do something, and vice-versa!

BILL DACHELET

Smyrna, GA
Dachelet@Aol.com

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Dear Stan,

The letter from Shari Prange (September 1996) overlooks one reason for children falling into poverty in larger numbers than adults: divorce. Consider a household consisting of two adults and two children, in which the combined equal incomes of the adults put the household barely above the official poverty line. If this household were to split evenly into two households of one adult and one child each, it is possible that both would now be below the poverty line. (I don't know exactly how the official "poverty line" is calculated, but I believe it considers both income and family size.) In this case, of course, the growth of the number of children in poverty only equals rather than exceeds that of adults.

The above example, however, is rarely what happens. In the first place, it is seldom the case that each adult keeps one child. The far more likely scenario is that the two-adult, two-child household will split into one one-adult, two-child household and one single-adult household. If we continue to postulate equal, but low, incomes for the two adults, it is entirely possible for the childless household to remain above the poverty line while the two-child household sinks below. In this case, the number of children in poverty increases twice as fast as the number of adults.

In the second place, the equal-earnings postulate is unrealistic; more likely, the mother earns less than the father. Since the two children are more likely to stay with their mother, this increases the odds that these three will become officially poor, while the father does not. If the mother's sole occupation before the household split was child care, it is even more likely that she will get custody, and even less likely that she will be able to support her children above the poverty level. (Obviously, child-support and alimony payments will change this picture if they are both awarded and payed. Often they are not.)

How common is this divorce-leading-to-poverty scenario? I can't say. I do know that single-parent families are more likely to live in poverty than two-parent families; and I have read, but not verified, that there are more children living in single-parent families because of divorce than because of out-of-wedlock births.

If the disproportionate increase in children in poverty is due more to the splitting-up of previously solvent households than to low-income people having too many children, then Ms. Prange's proposed solution of encouraging prople to delay and limit childbearing (which I support for other reasons, and not only for people in lower income brackets) will *not* do anything for the poverty issue. Other measures will clearly be needed.

There are many possible ways of approaching this problem. Perhaps custody arrangements should be changed, with children going to the higher-income parent, or one child to each parent. Increasing actual income transfer through child-support and alimony payments might be another means. Preventing households from splitting in the first place is a third possibility, although it may be difficult

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to accomplish. (Some politicians have talked about making divorce more difficult, but this would still leave open the possibility of informal separations. Indeed, while I used the word "divorce" at the beginning of this letter, the situations I've described do not depend on a couple's being legally divorced, or even legally married.) A fourth possibility would be to increase the job skills and job opportunities of women so that they can support their children without a partner.

Any of the above measures would contribute to solving the problem of children moving into poverty through divorce. Some of them may be incompatible with others, or have undesirable side effects. My purpose is not to recommend any of them, but to remind *Analog* readers that it is important to find out the real nature of the problem (through the good old scientific method of empirical observation) before trying to design and implement a solution.

SONDRA VENABLE
85-10 34th Ave. #321
Jackson Heights, NY 11372

Dear Editors,

As I am writing this note, the DC-XA vehicle is burning at the White Sands Space Harbor. The final flight of the original test program was flown today and everything appeared normal until touchdown. It appears that the landing gear did not deploy. After touching down on the sand, the engines shut down and the vehicle fell over on its side. An explosion followed and the remains are currently burning.

More details will follow as they become available. A video will be supplied as soon as the image is released. I'm sorry it's not better news. And the first thing the news media said was "*NASA* loses another. . . ."

The DC-X was not, ever, in any way, one of NASA's. In fact, a lot of people were crowing smugly about how private industry was "doing so much better than NASA."

The saddest part is that even this is not likely to get it through those people's heads that getting into space is *not* comparable to flying a plane.

"Building a cheap spaceship in your backyard" is a ridiculous fantasy, perpetrated by people who really have no clue how much work is actually involved.

One failure does not cripple a program. NASA got back into space after Apollo 1, Apollo 13, Challenger, and several other less-remembered failures.

Orbital Sciences is still flying despite numerous egregious problems. Same for Ariane. Same for the Russians. So should the DC-X. So should any other company which undertakes getting into space.

Nobody ever said it would be easy. NASA just makes it look that way.

Remember that. NASA may not be where SF fans and space advocates would like them to be, but NASA *is* flying into space on a regular basis.

GRADY MCCRIGHT

To the Editors,

Enough already! It is time to put these stories together and quit parceling them out piecemeal!

I refer, of course, to "Snowball,"

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"Fluffy," and "Puff." I'm *impatient* with serials that run on monthly installments; but to have to wait years for the "rest of the story" is just a bit much! (1993 to 1996!) Even tho' I was a very young subscriber in the late fifties—I'm starting to show signs of late adolescence now and I fear that I may never get to finish this excellent series.

All kidding aside, Jeff Kooistra's kitten stories are a lot of good fun and I, for one, hope someday to buy the book! In the meantime, would it be possible to get reprints? In all my years of SF, this is my very first fan letter. (Anyone may check the back issues of *Analog* for the last 37 years to verify this statement.)

Mr. Kooistra, thank you very much!

PAUL P. ROBINETTE, JR.
4476 Constellation Drive
Millington, TN

The author replies. . . .

I'm delighted that Mr. Robinette so enjoys my cat stories, but he is laboring under the misconception that I'm "parceling them out." Sir, I haven't written any more yet! I didn't even intend to write a sequel to "Puff," but then the idea for "Fluffy" came, and Stan suggested the name "Snowball," and then it became clear to me that, like "The Far Side" and cows, I can do cat stories for the rest of my life.

I do have the next one in mind, and even have something of a future history tentatively mapped out for the kittens. But believe me, if I had the whole shebang together already, I would be trying to publish them as a book!

Thank you for an uplifting letter, Mr. Robinette! Letters like yours are better than payment checks (but don't get any foolish ideas, Stan).

JEFFERY D. KOOISTRA

Dear Dr. Schmidt,

Amazing how technology can sneak up on one—and go on by—without being noticed. . . .

About seven years ago, a friend gave me a twelve-month subscription with a local internet service provider as a birthday present.

I never used it as I had no use for a "bulletin board service" at the time

A couple of months ago, I sent off a check to *Analog* to extend my current subscription. This week I received the July issue—two copies. A glitch in the instructions sent with my check meant that now I had two overlapping subscriptions!

The phone number given in *Analog* for the Harlan subscriptions office cannot be used by callers outside the country—but your e-mail address can! A request to your office brought a reply very shortly giving the required number. A quick call to Harlan got the problem fixed—all for about the cost of an airmail stamp, and no waiting . . . top service, and thanks due to the people involved.

Seems I'm starting to catch up with that technology.

JOHN DOWDALL
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johnd@escape.net.au ■

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UPCOMING EVENTS Anthony Lewis

27–30 March
NORWESCON 20 (Seattle-Tacoma area SF conference) at Red Lion Hotel, SeaTac Airport, Wash. Artist Guest of Honor—Vincent Di Fate, Science Guest of Honor—Robert L. Forward. Registration—$50 at the door. Info: Norwescon 20, Box 24207, Seattle, WA 98124. (206) 270-7850. e-mail nwc@eskimo.com

18–20 April
NEBULA AWARDS BANQUET (SFWA Awards presentations and program) at Crown Plaza Hotel, Kansas City, Mo. Info: Nebula Weekend, c/o Keith Stokes, 2213 East Cedar St., St. Olathe, KS 66062. e-mail: rbailey@net-com.com

18–20 April
NAME THAT CON 10 (Missouri area SF conference) at Harley Hotel, Earth City, Mo. Guest of Honor—Laurell K. Hamilton, Artist Guest of Honor—David Martin, Fan Guest of Honor—Susan Eisenhour, TM—Mickey Zucker Reichert, Special Guest of Honor—Wilson Tucker. Registration—$20 until 28 February 1997, $25 thereafter. Info: NameThatCon, Box 575, St. Charles, MO 63302. (314) 583-5193. email: randy@ecmail.ecc.cc.mo.us

16–18 May
OASIS 10 (Orlando area SF conference) at Harley Hotel, Orlando, Fla. Guest of Honor—STANLEY SCHMIDT, editor of *Analog*, Artist Guest of Honor—Ron Walotsky, Fan Guest of Honor—Ray Herz. Registration—$22 until 15 March 1997, $25 at the door. Info: Oasis, Box 940992, Maitland, FL 32794-0992. (407) 263-5822

28 Aug–1 Sep
LONESTARCON 2 (55th World Science Fiction Convention) at San Antonio Convention Center, San Antonio, Texas. Guests of Honor—Algis Budrys and Michael Moorcock; Artist Guest of Honor—Don Maitz; Fan Guest of Honor—Roy Tackett, TM—Neal Barrett, Jr. Registration until 31 December 1996 $120; supporting $25; children 3 to 12 $40 (age as of 29 August 1997). This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info: LoneStarCon 2, Box 27277, Austin, TX 78755-2277. (512) 435-7446 (voice), (512) 435-7747 (fax), lsc2@io.com

Convention runners: If your convention has a telephone, FAX, email, or Web page URL, please let us know so that we can publish this information.

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TECHNOLOGY UPDATE

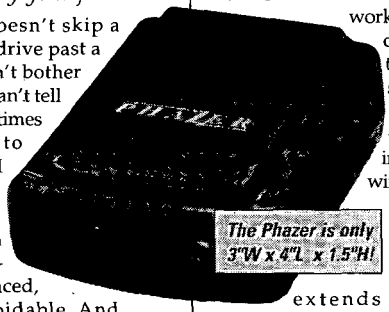
How to make your car invisible to radar and laser...*legally!*

Rocky Mountain Radar introduces a device guaranteed to make your car electronically "invisible" to speed traps—if you get a ticket while using the product, the manufacturer will pay your fine!

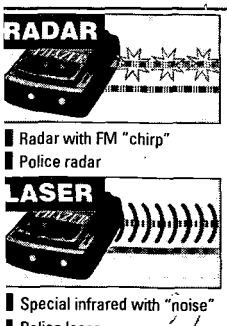
■ *The Phazer will "jam" both radar and laser guns, preventing police from measuring your speed.*

If your heart doesn't skip a beat when you drive past a speed trap, don't bother reading this. I can't tell you how many times it's happened to me, even if I wasn't speeding.

It seems with speed-detection technology getting more advanced, tickets are almost unavoidable. And although devices exist that enable motorists to detect these speed traps, they are outlawed in many states...including mine.



The solution. Today, Rocky Mountain Radar offers a solution—the Phazer. Combining a *passive* radar scrambler with an *active* laser scrambler, it makes your automobile electronically "invisible" to police speed-detecting equipment.



■ Radar with FM "chirp"
■ Police radar
■ Special infrared with "noise"
■ Police laser

HOW TO MAKE YOUR CAR DISAPPEAR

Radar and laser scramblers are devices that foil speed traps by making vehicles electronically "invisible" to police radar. Radar and laser scramblers mix a portion of the signal with background clutter and reflect it back to the squad car. This technique creates an unreadable signal that confuses the computer inside the radar gun.

■ *The Phazer makes your car invisible to police radar and lasers or the manufacturer will pay your speeding ticket!*

How it scrambles radar. Police radar takes five to 10 measurements of a vehicle's speed in about one second. By mixing an X, K or Ka radar signal with an FM "chirp," the Phazer sends one signal that tells the radar the car is going 15 m.p.h. and another signal that the car is going 312 m.p.h. Because police radar can't verify the speed, it displays no speed at all.

Works with laser, too! The Phazer also works against Lidar that use the change in distance over time to detect a vehicle's speed. The Phazer uses light-emitting diodes (LEDs) to fire invisible infrared pulses through the windshield. This gives a false indication of the car's distance, blocking measurement of your speed. Its range of effectiveness extends from as far as three miles to almost 100 feet away from the trap.

Ticket rebate program. Rocky Mountain Radar is so confident that the Phazer will work that if you do get a speeding ticket within the first year while using the Phazer, they will pay your fine if the speed limit was not exceeded by more than 30%, or 15 miles per hour, whichever is less.

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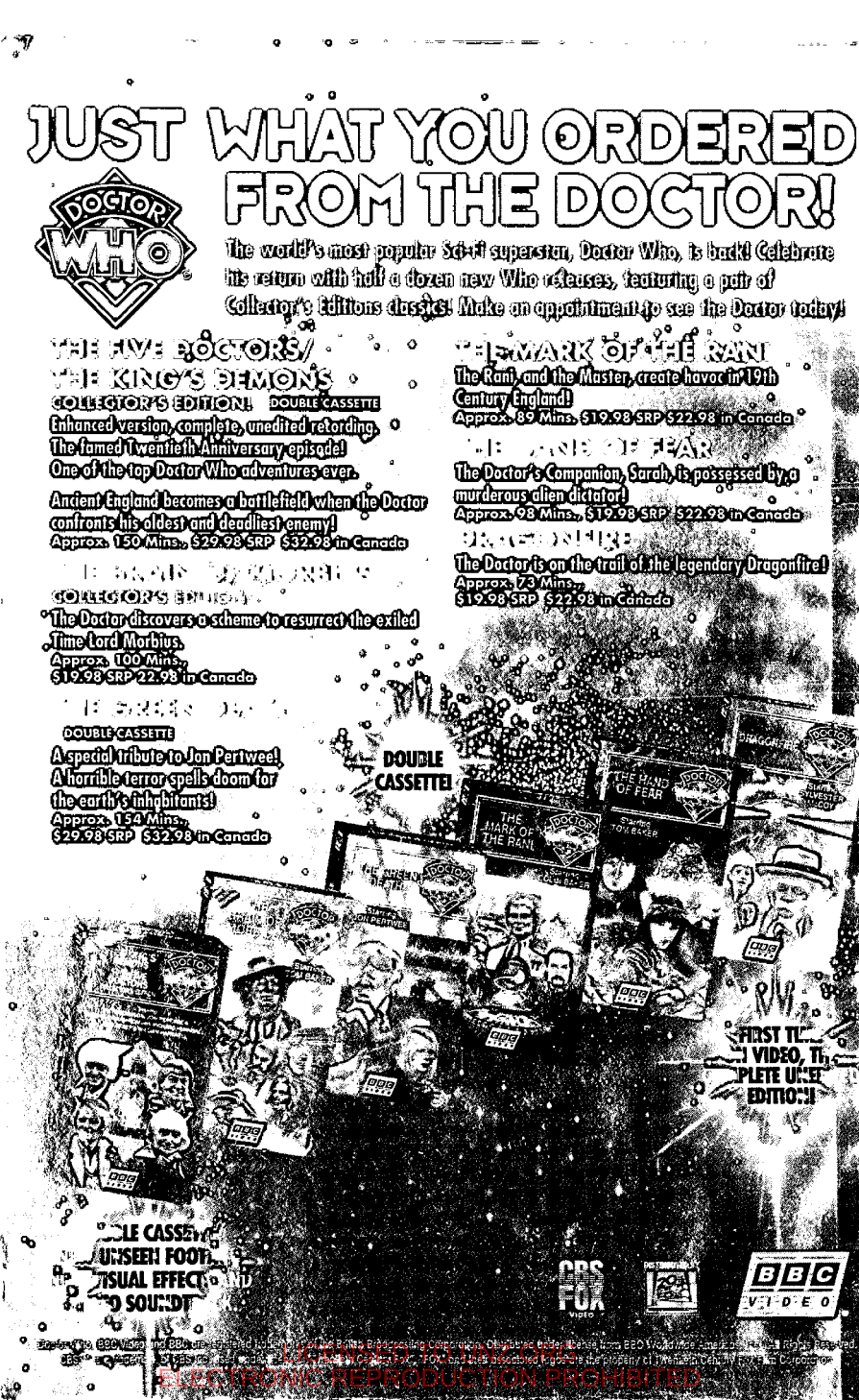

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